The Revolution After Next:
Making Vertical Envelopment by Operationally Significant Mobile Protected Forces a Reality in the First Decade of the 21st Century

A Monograph
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ABSTRACT

The Revolution After Next: Making Vertical Envelopment by Operationally Significant Mobile Protected Forces a Reality in the First Decade of the 21st Century by MAJ Vincent J. Tedesco III, USA, 66 pages.

As the 21st Century dawns, warfare is in the midst of revolutionary change. Information Age warfare characterized by knowledge, speed, and precision is slowly supplanting Industrial Age war and its reliance on mass. The advent of precision firepower is but the first tremor of this tectonic shift. As it reverberates around the globe, the Precision Firepower Military Technical Revolution will dramatically increase the lethality and reach of defensive fires. Unless the means for offensive maneuver adapt to overcome the greatly enhanced power of the defense, future soldiers will face stalemate and indecision much like their forefathers confronted in 1914.

As the world's leading economic and military power, the United States has both the resources and the incentive to sustain its ability to conduct rapid, decisive land combat. As air-mechanization's theorists and the Army After Next Project have shown, the key lies in creating air-mechanized Precision Maneuver forces that profit from the synergy created by digitization, precision firepower, and vertical envelopment.

This monograph argues that there exists sufficient means and technology to create an initial Precision Maneuver rapid reaction corps before 2010. It would behoove the Army to embark on this project immediately. The nation's security demands the Army act now to build a new force, one that leads the next revolution in war by redressing the growing imbalance between fire and maneuver, one with the speed, reach, and precision required for rapid, decisive, land campaigns in the Information Age.

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CHAPTER ONE

Information Age War and The Anatomy of Revolution in War

A future enemy needs only the will and resources to develop his own means of precision strike.

Current Thoughts on the Army After Next, 1996 [1]

The current emphasis on a method of warfighting that emphasizes firepower at the expense of maneuver may well result in a protracted war characterized by stalemate, attrition, and unacceptable loss of life on both sides.

The Annual Report on The Army After Next Project, 1997[2]

May 23rd, 2010. Dateline: Manila. Early this morning, the armed forces of the People's Republic of China, seized Taiwan in a surprise precision attack that effectively ends the island's efforts to become an independent state. Following the pattern of previous American operations, the invasion began before dawn with stealth bomber and missile strikes on radar, air defense, and command centers. The People's Liberation Army (PLA) air strikes that followed destroyed Taiwan's air force and sank most of its warships. Within minutes of these attacks, Chinese paratroopers and special forces seized the Taipei, T'ainan, and Chiayi airports. As the gunfire from these attacks died down, Chinese transport aircraft began landing and disgorging armored vehicles and troops that fanned out to seize essential sites in each city. Concurrently, PLA helicopters delivered forces from the mainland that rapidly seized transportation, communications, and other sites in the surrounding countryside. Under the weight of this onslaught, organized Taiwanese military resistance collapsed by day's end. Though many expect guerrillas in the cities and mountainous interior to prolong the struggle, the Communists seem to be firmly in control of the island. Despite widespread outrage and condemnation from the world's capitals, China's veto power within the Security Council ensures that the United Nations cannot act to punish this Chinese aggression. To discourage any US-led coalition response,

China has announced a Total Exclusion Zone surrounding the island and has made it clear that it will interpret any attacks on its forces on Taiwan as an attack on the mainland. After today's US-style precision attack, it seems clear to all that China has the wherewithal to enforce its threats and the costs of any US military response will have to be carefully weighed before Washington acts.

This fictional account of the fall of Taiwan illustrates the dark side of the changes afoot in the conduct of war today. Beginning with the 1991 Gulf War and continuing through NATO operations against Serbia in 1999, coalitions led by the United States have demonstrated unequivocally the powerful synergy of sensor, information, and precision munitions technologies. In all cases to date, it has been the unique ability of the United States to acquire and strike targets with precision weapons that has proved decisive. While its technological leadership will linger, there is no reason to expect the American monopoly on precision strike to last. The model and means are already in our future opponent's hands. Previous operations and the global diffusion of the enabling technologies have provided would-be aggressors with a blueprint for acquiring a similar capability.[3]

Indeed, the United States Department of Defense expects that in the early 21st Century, precision munitions and advances in information technology will produce an order of magnitude improvement in weapons lethality creating if you will, the Precision Firepower Revolution of 2010.[4] This will create a situation strikingly reminiscent of what historians describe as the Firepower Revolution of 1914. In the years leading up to the First World War, machine guns and artillery dramatically increased the lethality of tactical defensive fires, while doctrinal and organizational adaptation languished. Unable to achieve decision through offensive action with the existing means, in 1914 armies entrenched to escape the lethality of contemporary weapons. The result was four long years of slaughter, indecision, and plodding adaptation to the new realities of war. While mass fires enhanced tactical lethality in 1914; enhanced precision and extended range weapons will create the same effects in the operational battlespace by 2010. Thus, the United States military will face a situation analogous to 1914 as precision munitions

and information technologies exponentially increase of opponent's defensive fires. In the Precision Firepower Revolution, these technologies and the concomitant innovations in organization and doctrine will fuse into what foreign observers have labeled "reconnaissance surveillance complexes" (RSCs).[5] These RSCs will combine near-omniscient targeting information and the ability to deliver high volume precision fires over operational distances.

Before further assessing the implications of such a dramatic development, a review of current thought on changes in warfare is in order. For at least a decade, one of the most vibrant topics in military historical and professional discourse has been the structure of military innovation. In this dialog, historians such as Geoffrey Parker, Michael Roberts, and Williamson Murray have advanced the concept of Revolutions in Military Affairs (RMAs). These are periods of revolutionary change in how societies and their military institutions prepare for and prosecute war. From the beginning, historians have struggled to refine the RMA paradigm to fit history's complexities and ambiguities. While early efforts focused on the technological, doctrinal, and organizational aspects of war, historians increasingly seek to locate RMAs within the broader matrix of change in society, politics, and economics. For example, it is impossible to fully explain the ways in which Napoleon Bonaparte revolutionized early 19th Century warfare without mentioning the rise of nationalism and the idea of national mobilization born in the French Revolution.

While important questions remain, recent articles by Williamson Murray and Clifford Rogers have combined to produce the most convincing and sophisticated articulation of the RMA concept available today. Rogers provides a model for RMAs that accounts for refinements of military technique between revolutions. Borrowing from contemporary work in the biological sciences, he argues that "punctuated equilibrium" — periods of incremental, evolutionary change interrupted by short bursts of rapid change — characterizes the evolution of Western warfare.[6] The pace of change in today's military environment suggest that the warfare is in one of these burst periods. (See Figure 1)

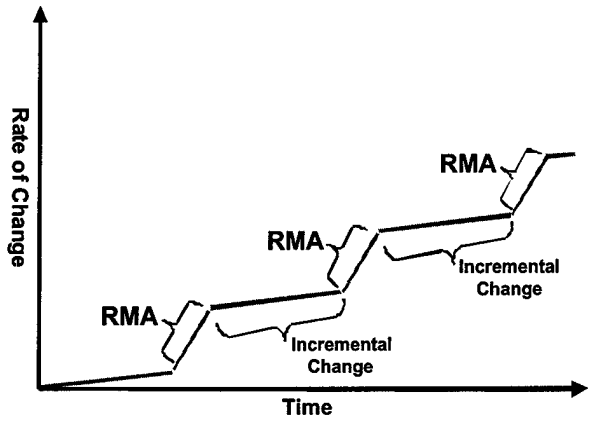

Figure 1 Rogers' Concept of Punctuated Equilibrium Applied to RMAs. As explained in Clifford J. Rogers, "The Military Revolutions of the Hundred Years War," *The Journal of Military History* 57, no. 2 (April) (1993), 277.

For his part, Murray adds two major refinements to the RMA model. First, he brings order to the debate by establishing a framework that subordinates Military Technical Revolutions (MTRs) to larger and more significant Revolutions in Military Affairs. Murray makes a geological analogy, comparing MTRs to tremors and RMAs to earthquakes. Just as earthquakes are the sum of multiple tremors, so are RMAs the product of minor changes that cumulatively affect structural alterations in warfare, politics, economics, and society. Murray argues that MTRs produce dramatic effects, but ones confined within the practice of the military art and science.[7] (See Figure 2) The advent of rifled weapons, for example, had enormous military implications, but was only one part of a larger RMA that encompasses the military implications of the Industrial Revolution and the rise of nation-states. This suggests that today's Precision Firepower Military Revolution may only be a single tremor within the larger earthquake of changes in warfare associated with the arrival of the Information Age.

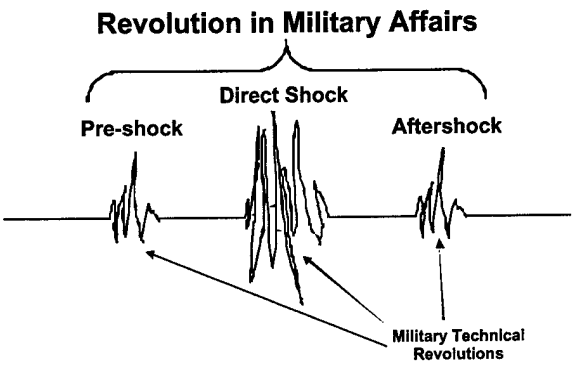

Figure 2 Williamson Murray's Earthquake Metaphor for Understanding Change in Warfare. As described in Williamson Murray, "Thinking About Revolutions in Military Affairs," *Joint Forces Quarterly*, no. 19 (Summer) (1998), 73.

Murray's second major insight also addresses the relationship between the various elements of military innovation within the RMA paradigm. By implication, Rogers' punctuated equilibrium model implies a linear process of change composed of discrete, sequential RMAs. Murray dispels this idea by arguing that RMAs overlay rather than replace each other. Only in this fashion can the RMA model adequately explain how the cumulative effects of innovation generate a synergy that increases the pace and intensity of change.[8] (See Figure 3)

This refined RMA framework helps one to place the rise of Precision Firepower in context. It is widely acknowledged that warfare like society and economics is in transition between the Industrial and Information Ages. Large national armies and massed, indiscriminate firepower employed in linear operations characterized war in the Industrial Age. In such contests, self-sufficient continental powers such as the United States and the former-Soviet Union enjoyed quantitative material advantages that smaller states simply could not match. Consequently, such states prevailed in wars of attrition and exhaustion where they could bring their superior capacity for national mobilization to bear.

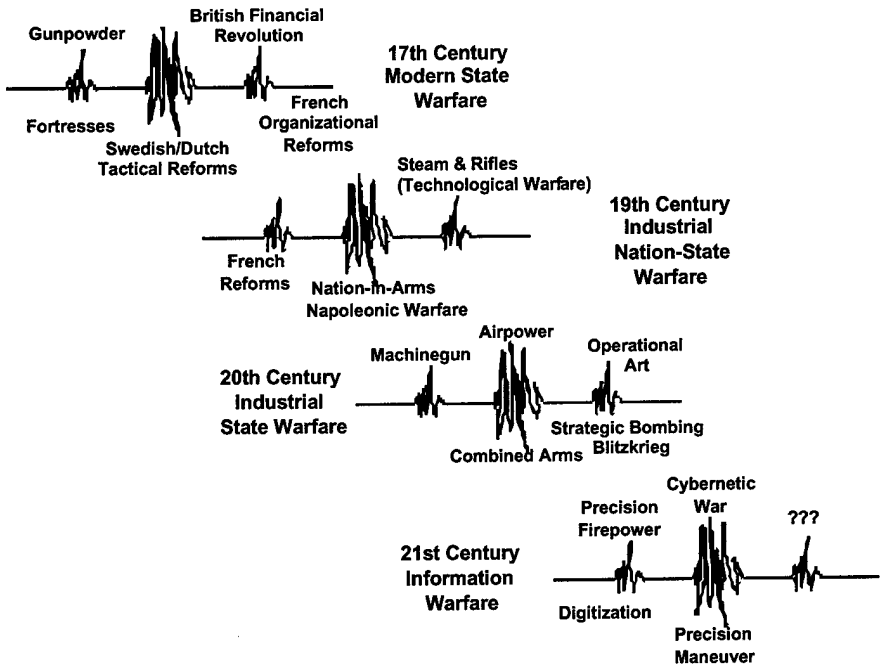

Figure 3 Historical Evolution of the Western Way of War. Adapted from Williamson Murray, "Thinking About Revolutions in Military Affairs," *Joint Forces Quarterly*, no. 19 (Summer) (1998), 73.

War in the Information Age will likely be very different. The preferred means of defeat will shift from attrition and exhaustion to the comparatively efficient mechanism of cybershock. As described by Dr. James J. Schneider, cybershock is "the systematic paralysis of an army [or perhaps a society] through its inability to direct and control itself efficiently."[9] Alterations in the context of interstate relations compel this shift. Except in the most extenuating of situations, political and economic interdependence will impinge on the ability of even continental powers to prosecute large-scale war. Moreover, access to the supranational information architecture and global news media will mitigate against strategic surprise and create intense domestic and international pressure to limit the duration and effects of overt hostilities. This environment will place a premium on precision and rapid decision, two qualities amenable to cybershock.

While the United States currently is the undisputed leader in developing the means of Precision Firepower MTR, the widespread availability of the enabling technologies in the global arms market will make this advantage a fleeting one. As a hegemon interested in stability, the

United States may have the most to lose as a result in this MTR. While aggressors will not be able to defeat forward-deployed U.S. forces, they will be able to exploit the limitations inherent in a distant power projection force. As the example of the fall of Taiwan suggests, careful planning and preparation will enable an enemy to rapidly seize territory and then assume the defensive, expecting that their reconnaissance surveillance complexes and information operations will defeat any attempt to undo their aggression. Thus, the United States military must develop the means to overcome powerful operational defenses based on precision firepower.

History and common sense suggests it is in the United States' interest to restore the balance between fire and maneuver. Throughout Western military history, the pendulum of ascendancy has swung back and forth between the firepower and maneuver elements of combat power. (See Figure 4) Consider the example of the aforementioned Firepower Revolution. By 1918, all the major powers had developed means to penetrate the tactical defenses of their enemies. In the case of the Germans, it was "storm troop" tactics. For the Western Allies, it was the coordinated employment of artillery, tanks, and infantry. During the interwar years, the Soviets and Germans developed advanced operational concepts for combined arms mechanized warfare that redressed the imbalance between maneuver and fires. These concepts in turn became the dominant paradigm for high-intensity land war through the end of the 20th Century. Indeed, it was the challenge of defeating such a Soviet offensive in Central Europe during the Cold War that spurred the development of the technologies that today are bearing fruit in the Precision Firepower MTR.

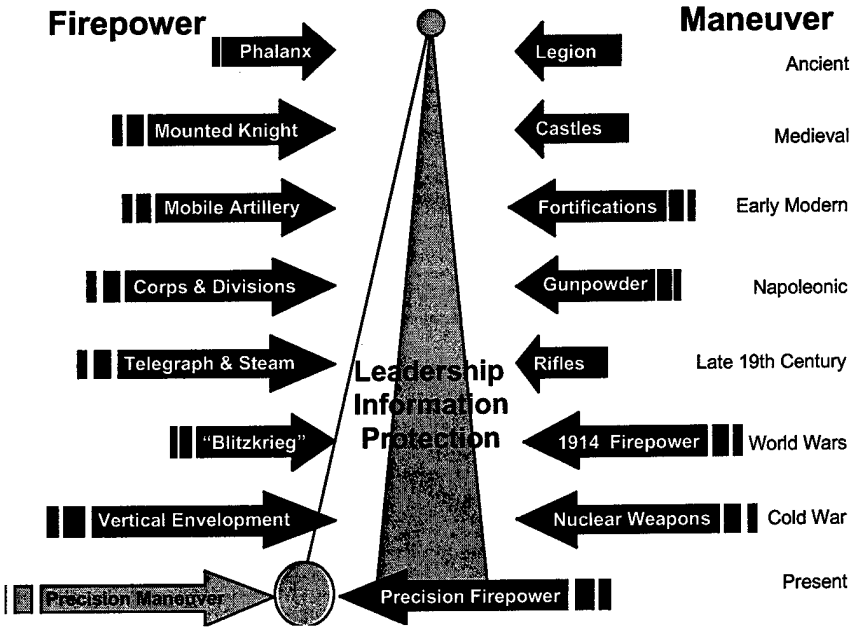

Figure 4 The Firepower-Maneuver Balance.

Army experimentation and other sources suggest that the means for overcoming a dramatic increase in the power of operational and tactical defenses lies in Precision Maneuver. Building upon enhanced situational awareness enabled by digitization, Precision Maneuver rapidly brings overwhelming combat power to bear on the critical nodes throughout the depth of an enemy defensive system causing paralysis, shock, and ultimately, decision. It demands a force with ultramobility across operational and tactical distances, an advantage only attainable through air-mechanization. Accordingly, the key to future offensive land war lies in building operationally significant ultramobile formations capable of vertical envelopment. Imagine a corps-sized force with the ability to air assault mechanized units armed with the tools of the Precision Firepower MTR into the depths of an enemy defensive complex. Largely unconstrained by the physics of ground mobility, such a force would have the speed and agility required to rapidly collapse a reconnaissance surveillance complex and thereby deliver decision.

As will be shown in the succeeding chapters, in Army After Next wargames such a force was used in conjunction with more conventional direct pressure forces to rapidly and decisively defeat enemy RSCs. While the Russian, German, and British militaries already possess some tactical air-mechanized capability, for the foreseeable future only the United States has the wherewithal to realize an operationally significant air-mechanized capable of Precision Maneuver. Such a formation is a logical extension of the Chief of Staff's initiative to reshape the Army to enhance its relevance and responsiveness. As that transformation effort progresses, the Army should concurrently begin to reshape its rapid reaction corps into a Precision Maneuver force. As this monograph will show, the means exist to field an initial, Precision Maneuver, XVIII Airborne Corps using off-the-shelf technologies before 2010.

The following pages will explore issues associated with creating an operationally significant, Precision Maneuver force a reality in this decade. They will first examine in greater detail the challenges of future land warfare, then turn to the theory and practice of air-mechanization in foreign armies. The succeeding chapter will explore the development of U.S. air-mechanization through the Army After Next Project. Finally, this monograph will propose a plan to transform the XVIII Airborne Corps into air-mechanized formation using existing programs and technologies.

[1] Deputy Chief of Staff for Doctrine, *Army After Next Project: Current Thoughts on the Army After Next* [Presentation] (U.S. Army Training and Doctrine Command, 1996. Emphasis in the original.
[2] "Knowledge and Speed: The Annual Report on The Army After Next Project to the Chief-of-Staff of the Army," (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1997), 4.
[3] Those who dismiss the likelihood of such a development would do well to remember that the greatest costs associated with any new military capability are incurred during the long process of research, development and testing that precedes an operational capability. The ironic consequence of American military research and development is ultimately to drive down the price of our competitor's acquiring comparable capabilities. Thus, any American technological advantage is inherently fleeting and must be continually replenished.
[4] Chairman of the Joints Chiefs of Staff, *Joint Vision 2010* (Washington, D.C.: United States Department of Defense, 1996), 11-13. The term Precision Firepower Revolution is this author's label for this set of changes described in *Joint Vision 2010.*
[5] U.S. Army World Class Opposing Force doctrine adapted from Soviet doctrine describes an RSC as integrating "reconnaissance and target acquisition and weapon systems into a closed-loop, automated strike system that detects, identifies, and destroys critical targets in minutes." See Department of the Army, "Field Manual 100-61: OPFOR Armor-and Mechanized-Based Opposing Force Operational Art," (Washington, D.C.: 1998), 9-10.
[6] Rodgers, Clifford J. "The Military Revolutions of the Hundred Years War." *The Journal of Military History* 57, no. 2 (April) (1993): 277. Rogers borrowed the paradigm of punctuated equilibrium from Stephen Jay Gould and Niles Eldridge's work on evolution..
[7] Williamson Murray, "Thinking About Revolutions in Military Affairs," *Joint Forces Quarterly*, no. 19 (Summer) (1998), 73.
[8] Ibid., 71.
[9] James J. Schneider, "A New Form of Warfare," *Military Review* 80, no. 1 (January-February) (2000), 56.

CHAPTER TWO

21st Century Land War and the Theory and Practice of Foreign Air-mechanization

> The American method of war-making in the future must rely on the offensive if this nation intends, as a matter of policy to retain the ability to strike rapidly, decide quickly, and finish wars cleanly with minimal loss of life to all sides.
>
> *The Army After Next Project Annual Report,* 1997 [1]

As the world's sole superpower, a major beneficiary of free trade, and the first state of the Information Age, promoting stability and containing conflict are in the United States' interests. Its National Security Strategy orchestrates all the elements of national power toward that end, but in any violent conflict American power depends on the efficacy of its military forces. Since only the offensive delivers decisive, positive results in war; U.S. military forces must ensure their offensive capacity continue to overmatch any potential opponent's defenses. As the means of the Precision Firepower Military Technical Revolution diffuse, the U.S. military must develop technologies, doctrines, and organizations that preserve its capacity for rapid, decisive operations. A solution to this requirement is at hand. By combining the existing ideas of air-mechanization and precision firepower, the Army can create a unique capability for operationally significant Precision Maneuver. Before proceeding to describe how the Army might realize that capability in this decade, it is first necessary to place this transformation in context by examining the challenge posed by precision firepower-enabled defenses and the state of foreign air-mechanization theory and practice.

The tools of the Precision Firepower MTR are readily available to any group or state with the money and desire to wield such weapons. In a 1998 study, the Army concluded that four areas of proliferation threaten the ability of the U.S. to conduct offensive operations. First was the increasing availability of long range precision weapons in the world arms market. Second was the spread of weapons of mass effects such as nuclear, biological, and chemical (NBC)

weapons. The third area of concern was the diffusion of long and medium range ballistic and cruise missile technologies. Finally, the report noted that access to space and the global information infrastructure promises to enhance command, control, coordination, communications, intelligence, surveillance and reconnaissance (C^4ISR) for other militaries much as it has done for the U.S.[2]

As opponents of the United States acquire these technologies, they will adapt their military plans accordingly. As in the case of the Taiwanese example offered at the start of the preceding chapter, future aggressors will likely attempt to seize adjacent territory by means of a strategic *coup de main*. To attain surprise in an environment of pervasive sensors and information, the attacker will mount his attack with forces in being operating from their peacetime garrisons. Precision firepower will afford the aggressor the means to induce cybershock and then rapidly maneuver traditional forces to exploit its effects. After presenting the world with an apparent *fait accompli,* the aggressor will establish operational and tactical exclusion zones to prevent the unimpeded intervention of outside forces. (See Figure 5) The dimensions of such exclusion zones will be a function of the technical characteristics of the reconnaissance surveillance complexes the aggressor establishes to protect his ill-gotten gains.[3] A wise aggressor will also mount a concurrent information campaign to stymie a coherent international response.
The military component of any response to such an act of aggression will hinge on the ability of the force to overcome these enemy reconnaissance surveillance complexes. To expel the aggressor, the attacking force must bring ground forces to bear within the theater, but the aggressor's RSC exists to make this prohibitively difficult. It presents the attacker with an unpleasant dilemma. He either attacks the system of systems that comprise the RSC or attempt to overwhelm its ability to service targets. The latter is expensive in terms of personnel and equipment losses while the former requires patience and a measure of technological superiority, neither of which can always be assured.

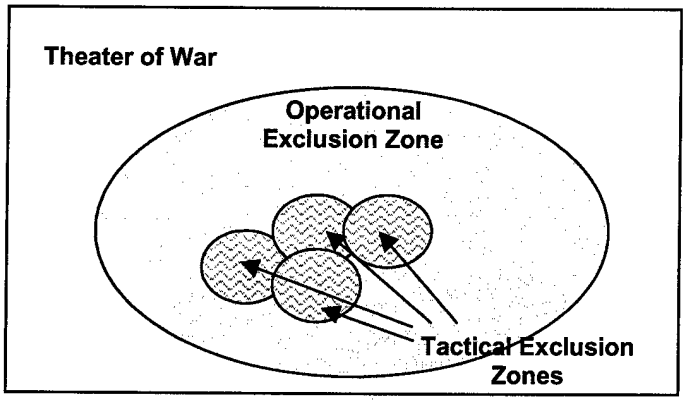

Figure 5 Overlaping Exclusion Zones in a Theater of War

Before describing a means to overcome this dilemma, one must understand how the reconnaissance surveillance complex evolved. The Precision Firepower Military Technical Revolution and the RSC are both products of Cold War Era attempts by the West to fashion defenses that could defeat an attack by Soviet conventional forces. Over the course of its seventy-year existence, the Soviet Union optimized itself to conduct sustained land combat. Its primary tool for such a conflict was mass armies operating in accordance with the doctrine of Soviet operational art. Until the U.S. Army introduced AirLand Battle doctrine, Soviet operational art represented the most mature approach to combined arms mechanized warfare. The imperatives of this doctrine were concentration, echelonment, and mass. Soviets expected to collapse NATO defenses on a broad front by concentrating enormous combat power on narrow frontages to create multiple penetrations. They then intended to exploit these penetrations with deeply echeloned forces. Echelonment ensured the Soviets could delay culmination by mounting successive operations, keeping the NATO defenders off balance and preventing them from restoring the integrity of their defenses. Such concentration and echelonment required a massive force trained and available for almost immediate use. Not until the 1980s did the West acquire the doctrinal, organizational, and technological means to defeat the Soviet operational art without resorting to nuclear weapons. That decade saw a significant increase in the ability of defensive fires to use precision and deep reach to defeat a Soviet-style attacking force. As Soviet writers assessed the effects of AirLand Battle, precision munitions and deep attack on their operational

art, they coined the term reconnaissance surveillance complex to describe the emerging challenge.[4]

In the first decades of the 21st Century, it is reasonable to expect that the effects of precision firepower will continue to enhance the power of defenses. As the Army's Advanced Warfighting Experiments have shown, the current state of information and communications technology is such that only stationary forces can fully realize the synergy of an RSC.[5] So long as this situation persists the existence of reconnaissance surveillance complexes will afford operational and tactical defenses a substantial advantage. This is because the enhanced firepower of RSC-enabled defenses fundamentally changes the equations that underlay combined arms warfare. Indeed, Army After Next studies recognize the ascendancy of the defense, noting that "offensive action based on large-scale maneuver will entail considerable risk to piecemeal destruction from a fire storm of precision munitions."[6] Just as indirect artillery fire and machine guns expanded the tactical deadly ground in 1914, RSCs achieve these effects by increasing the size and lethality of the operational battlespace to the defender's advantage. In doing so they negate the advantages of echelonment by subjecting forces throughout the battlespace to the effects of devastating fires that attrit formations before they can be brought to bear in the close fight. Likewise, the sensors and information technology embedded in an RSC make it possible for the defender to detect the attacker at a greater range and then mass fires more accurately and speedily.[7]

Achieving Enhanced Speed and Mobility through Air-mechanization

> Warfare stands at a watershed: on the one side mechanized forces are slowing down against the mounting power of attrition by modern firepower, while on the other current helicopters... have the ability to restore the power of maneuver to armies.
>
> General Doctor Ferdinand von Senger und Etterlin, 1987[8]

> Unless the speed of movement increases substantially, ... improvements in detection and precision fire delivery will make offensive action infinitely more difficult.

The Army After Next Project Annual Report, 1997[9]

The key to defeating 21st Century defenses lies in achieving a synergy between speed, knowledge, and precision. First, the attacker's information architecture must provide him with the situational awareness and efficiency of command and control necessary for precision fires, maneuver, and logistics. Second, the attacker must bring fires to bear on the enemy system. The focus of these fires must be on restoring maneuver by degrading the defender's reconnaissance surveillance complex.[10] Finally, the attacker must rapidly maneuver forces to exploit the effects of these fires. This is a critical point. Information and fires are crucial enabling actions, but they cannot alone deliver decision. Even in the Information Age, victory rests ultimately on the capacity of an army to close with and complete the destruction of its enemy. This is because the principle effect of firepower — even precision firepower — is psychological not physical. This effect is greatest early in firepower's application and declines over time as the enemy adapts.[11] The longer the bombardment drags on the more strength the enemy regains. Therefore, the path to rapid decisive operations with a low cost is to make the most of the early paralysis induced by fires.[12] To do so, the attacker's maneuvering force must be dramatically more mobile than the force it is striking.[13] Today's armies reflect an outdated solution to that challenge. In 1940, the mechanized striking arm of the German Army proved sufficiently mobile to exploit the effects of the massed air strikes on the less mobile French Army. But times have changed and the pervasive mechanization and motorization of modern armies means that the attacker's mechanized forces no longer have such a mobility advantage. Indeed, recent Army studies estimate that a future attacker will need at least a twofold increase in the speed of his maneuver and such an increase is only possible by maneuvering in the vertical dimension.[14]

The maneuver of ground combat forces in the vertical dimension is not a new idea. Since the advent of manned flight early in the last century, visionary soldiers have looked to the sky for new ways of maneuvering. Vertical envelopment by airborne and air assault forces represents the

two major fruits of these efforts. In American practice, this has meant the delivery of foot-mobile infantry in tactical operations such as raids or attacks to seize and hold objectives pending link-up with a conventional maneuver force.[15] While such a capability will undoubtedly remain useful, Precision Maneuver demands the creation of a more powerful force with substantially greater residual capacity for ground maneuver. Fortunately, the theorists and practitioners of air-mechanization have established an alternative approach to vertical envelopment that rises to this challenge.

To gain an understanding of air-mechanization theory, one must study the writings of three foreign officers: Mikhail Tukhachevsky, Ferdinand von Senger und Etterlin, and Richard Simpkin. The father of air-mechanization was the military theorist and Soviet General Mikhail N. Tukhachevsky. A member of the nobility and a former Czarist officer, Tukhachevsky nonetheless rose within the ranks of the Red Army to become its Chief of Staff and one of the most visionary theorists between the World Wars.[16] Tukhachevsky's extensive study led him to conclude that air-delivered ground forces would play an important role in future war. Writing in 1931, Tukhachevsky described how the aerial insertion of motorized detachments would be "especially dangerous and demoralizing" to a defender.[17] He argued that the ability of airborne motorized forces to reach operational depths could make them a decisive part of a larger enveloping operation.[18] Tukhachevsky also suggested that a defending force would require an "antitank airborne motorized assault landing force" of its own to counter enemy air-mechanized forces.[19] In another application, the author foresaw that air-mechanized forces were ideal for exploiting the effects of aerial bombardment by the air force.[20]

Under Tukhachevsky's leadership, the pre-war Red Army experimented with air-mechanization on a small scale and developed a modest tactical capability. In 1931, Tukhachevsky created an "aviation motorized landing detachment" within his Leningrad Military District. From the beginning, this detachment included mobile protected firepower in the form of two T-27 tankettes, the contemporary term for lightly armed and armored tracked combat vehicles.[21] This detachment included a number of other vehicles and organic lift aircraft.

Limitations of scale and technology caused Tukhachevsky to organize this unit for minor tactical operations and restrict it to air landed combat vehicles.[22] Within a year of the detachment's creation, the Red Army issued the first doctrine ever written for an air-mechanized force, "Operational-Tactical Employment of Aviation Motorized Landing Detachments."[23] That same year, the Soviets reorganized Tukhachevsky's experimental aviation motorized detachment into an airborne brigade with an organic battalion-sized motorized/mechanized component. In the early 1930s, the Red Army added four more aviation motorized detachments to their force structure and Tukhachevsky campaigned for the creation of an "aviation motorized division" as an operational and strategic level force.[24] Tukhachevsky's murder in the Purges of 1937 snuffed out one of the brightest military minds of the century and temporarily discredited his ideas on air-mechanization. As will be discussed below, the Cold War Red Army would revive Tukhachevsky's ideas and create an impressive air-mechanized force.

In the West, the concept of air-mechanization first sprung from the writings of the German General Doctor Ferdinand von Senger und Etterlin. This *Wehrmacht* veteran became one of the first officers in the post-war *Bundeswehr* and before his death in 1987 rose to prominence as a military philosopher and the Commander of Allied Forces Central Europe from 1979 to 1983.[25] Von Senger's relevant English-language writings appeared in the *Journal of the Royal United Services Institute for Defence Studies* in the mid-1980s. In a wide-ranging essay titled "New Operational Dimensions," von Senger argued that history shows that either superior mobility or superior firepower can lead to victory, but their combination produces overwhelming victory.[26] He observed that recent increases in firepower had out-stripped increases in mobility.[27] Since he believed "only the combination of superior mobility and superior firepower have provided the military leader with the means for decisive operations," von Senger cast about looking for a means of combining the two with contemporary technology.[28] Since they had limited mobility once landed and could not sustain combat against heavy forces, he concluded that air-mobile light forces were not the answer. "What we are looking for," he argued, "is some way to make it possible to step from the intermediate stage of 'airmobility' to what I call 'airmechanization,'"

adding, "the means of transport must become a means of combat."[29] In his most visionary passage, von Senger proposed the creation of a "Main Battle Aerial Vehicle" or MBAV that combined the best tactical characteristics of a tank with those of an attack helicopter. He argued for the creation of a new MBAV-based combat arm for independent operations. Despite such bold statements, von Senger's views on air-mechanization reflect the peculiar conditions of the Cold War West German Army. He limited his operational concept for air-mechanization to defensive operations over friendly territory and under the protection of friendly air cover and air defenses.[30]

The third of the three foreign air-mechanization theorists was the British Brigadier Richard Simpkin. Like von Senger, Simpkin was a combat veteran of the Second World War. Afterwards, he became closely involved with British armored vehicle design, including playing a leading role in the development of Chobham armor. Simpkin became a military theorist in his retirement years, authoring numerous books before his death in 1986. As his obituary noted — and this author can testify — the Cambridge educated Simpkin was "a rather formidable man, whose thoughts were not always easily followed by ordinary mortals."[31]

Simpkin produced two works that specifically addressed the idea of air-mechanization.[32] In 1981 he published "An Air-mechanized Force for the 90s," in which he predicted that the M-1 Abrams and its contemporary vehicles represented the limits of what could be expected from surface mobility. For Simpkin, this meant that armies would have to adopt a new mode of mobility much as they did when mechanization replaced the horse. He argued that "the ultramobile elements have to get off the ground," offering the formula "*rotor is to track as track is to foot.*"[33] At this early point in his writings on the subject, Simpkin envisioned air-mechanization primarily in terms of using attack helicopters "to accelerate the development of critical points... and enhance shock effect."[34] He was very skeptical about the idea of an air-mobile light armored force, even arguing that dismounted troops were better suited for air-mobile raiding. Still he acknowledged that, "once the main maneuver force approaches what is probably

an absolute limit on cross-country mobility, the only place to look for a mobility boost is upwards."[35]

By 1985, Simpkin's thoughts on air-mechanization had changed, no doubt in part because of his study of von Senger and Tukhachevsky's writings on the topic. In *Race to the Swift,* Simpkin declared the MBAV the second "revolution of the rotor." He argued that such a hybrid concept was indeed feasible despite the lingering challenges of night operations, endurance, and vulnerability.[36] Notably, his vision of the MBAV carried both direct fire and precision indirect weapons.[37] He contended the MBAV approach to air-mechanization was preferable to the option of moving light armored vehicles with heavy lift helicopters.[38] Beyond expressing his approval for von Senger's MBAV, Simpkin provided his own views on how air-mechanized forces should be organized and employed. He envisioned an air-mechanized brigade of about a hundred combat vehicles and two thousand men.[39] Although he hinted that such a formation could operate in an expeditionary role from semi-submersible aircraft carriers, he confined his operational concept to the challenge of NATO's center.[40] Simpkin believed that the best way to employ his air-mechanized brigades would be to strike soft targets deep in the rear of an enemy army. In one example, he described how an air-mechanized brigade could seize an airfield for a follow-on air-landed airborne division.[41] Indeed, his ideal airborne division combined two air-mechanized brigades with an airborne infantry one (for airfield seizure) and a lift aviation brigade to move the light troops once they were dropped.[42] Throughout, Simpkin argued for the virtues of an air-mechanized force. He noted its unique ability to operate non-linearly and its ability to move dispersed and rapidly concentrate to fight. Finally, Simpkin also pointed out that the tactical momentum of an air-mechanized force came from its very high tempo and very low mass whereas the opposite is true of mechanized forces.[43]

Air-mechanization in Foreign Armies

Foreign armies have done much more than think about the possibilities of air-mechanization. To a limited degree, the British, German, and former-Soviet Armies have all fashioned a tactical air-mechanized operational capability. The Soviets even briefly created a seven division airborne air-mechanized force capable of operationally significant vertical envelopment.

The British have the most modest air-mechanized experience and capability. Their interest in air-mechanization dates from World War II when the British Army fielded the seven ton Tetrarch air-landed light tank.[44] Derived from a prewar design, this vehicle mounted a 40mm cannon and had only light armor. It was by design an armored reconnaissance platform, not a main battle or infantry support tank. The British equipped the Recce Regiment of their 6th Airborne Division with Tetrarchs. On 6 June 1944, Hamilcar gliders landed one company of Tetrarchs in Normandy, but these vehicles had little operational impact since the British used them in such small numbers. The British Army retained the Tetrarch until 1949 when they retired the Hamilcar and Tetrarch simultaneously.[45] More recently, the British fielded the air-transportable Scorpion and Scimitar armored reconnaissance vehicles.[46] When British forces moved into Kosovo in 1999, they made use of their limited capability for tactical air-mechanized movement. The British 5th Airborne Brigade slung all terrain vehicles and Scimitars under CH-47s Chinook helicopters. By doing so, they were able to bypass the mines, obstacles, and congestion that slowed the movement of U.S. and other forces into sector.[47]

Thanks to von Senger, the German Army has perhaps the most impressive tactical air-mechanized capability extant today. Its foundation is the airborne antitank battalion. A German air-mechanized brigade has three of these battalions[48] and each airborne brigade includes one. Four companies and a small headquarters comprise a battalion. (See Figure 6) The airborne antitank battalion derives its combat power from 61 MaK *Wiesel I* light armored vehicles.[49] (See Figure 7) The German Army began development of the *Wiesel* in the 1970s, but did not field it until 1990. Two variants, a TOW ATGM carrier and a 20mm automatic cannon carrier, comprise the German's inventory of *Wiesel Is*. Both the CH-53 and CH-47 can carry two of these three ton

vehicles internally.[50] The commander of an airborne antitank battalion explained how it operates thus: "this type of battalion fights as a 'pursuit' formation through its exploitation of large areas, in which it compensates for its lack of shock effect by its high mobility and flexibility of combat operations, thereby, combing optimal use of terrain with constant movement, interrupted only by stops for observation, to engage targets by fire, and to occupy covered positions."[51]

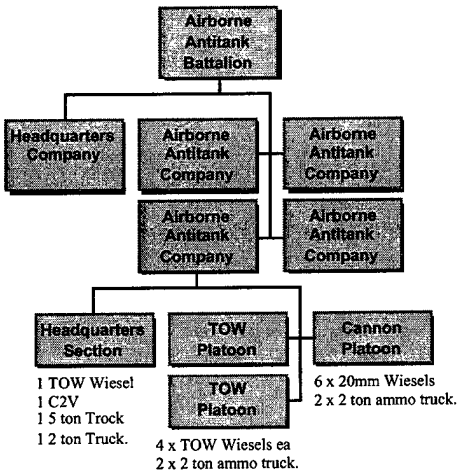

Figure 6 Organization of a German Army Airborne Antitank Battalion. Lieutenant Colonel Wolfgang Mettler, "The German Airborne Antitank Battalion and the Wiesel Armored Weapon Carrier," *Infantry* 85, no. 1 January-February (1995): 25-26.

Impressive as they are, these tactical German air-mechanized formations have significant limitations. First, they have no organic lift aircraft; drawing instead on a national pool of 100 CH-53s.[52] Second, the battalions have a very austere air-transportable logistical infrastructure that would limit their ability to conduct sustained independent operations.[53] Finally, even when task organized with the airborne brigade, the German airborne antitank battalion lacks the artillery, intelligence, and communications necessary to employ precision firepower-based

tactics.[54] Despite these constraints, the German Army has made use of its air-mechanized forces in recent NATO operations in the Balkans.[55]

Figure 7 German Army *Wiesel I* TOW Carriers unload from a CH-53 Helicopter. *MAK System Gesellschaft MBH - Light Airtransportable Armoured Systems* [WWW page] (The Website for Defence Industries - Army, 2000 [cited 26 March 2000]); available from http://www.army-technonology.com/contractors/armoured/mak/index.html.

Building upon Tukhachevsky's ideas and the peculiar requirements of their doctrine, the Soviet Army developed the most advanced air-mechanization program of the Cold War Era. The key to understanding the Soviet's interest in air-mechanization is to recognize that they viewed landing as the start — not the sum — of vertical envelopment operations. They believed that the ability of forces to continue to maneuver once landed made it worth the difficulty involved in getting them there in the first place.[56] As one Soviet officer observed, airborne forces "need the same qualities inherent in the troops attacking from the front: *a high degree of maneuverability* and the possession of all types of weapons, equipment and material means necessary for conducting long range military operations."[57]

In the immediate post-war years, there were initially no armored or mechanized vehicles in Soviet airborne units.[58] Recognizing the need for mobile protected firepower in their airborne divisions, in 1957 they equipped each with a small number of ASU-57 airborne assault guns.[59] This vehicle carried an obsolete 57mm antitank gun and a few projectiles in an open-topped and

very lightly armored chassis.[60] In 1961, the Red Army deployed the ASU-85 in an effort to address the shortcomings of the previous system. While still armed with an inadequate anti-tank cannon, the ASU-85 was better armored, fully enclosed, and possessed a suite of NBC defense measures. Unfortunately, the weapon's greater weight also meant it could only be air-landed.[61] In August 1968, the Soviets made operational use of their embryonic air-mechanized capability. During the invasion of Czechoslovakia, the Red Army air-landed these vehicles in Prague and used them to quickly seize control of critical points within that city.[62] Later in 1978, Soviet-led Cuban and Ethiopian troops used an air-mechanized force to defeat the Somali army in Ogaden. In an operation that required only three days to complete, they used helicopters to lift seventy ASU-57s and their supporting infantry into the Somali rear.[63]

The development and fielding of the BMD family of airborne armored vehicles represents the Soviet Army's single most important step toward air-mechanization. Indeed, one American officer has even suggested that, "the BMD may be the most important improvement of airborne equipment and armament in the history of the airborne."[64] The Soviets created the BMD specifically to provide airborne and air assault formations with the "secondary mobility" they believed such units required.[65] In its original configuration, the BMD was a seven ton, air-droppable, infantry combat vehicle that carried a crew of seven, a 73mm cannon, machine guns and an antitank guided missile (ATGM) launcher. Since 1970, it has evolved into a family of vehicles that enables a fully mechanized, combined arms, airborne force.[66] The Soviets had fully mechanized all seven of their airborne divisions by 1980.[67] Thus, the Soviet Union was the first state to field — albeit briefly — an operationally significant air-mechanized force. As one military observer noted in 1990, "the Soviet airborne forces are the only ones in the world which are entirely mobile and have good enough support to fight a sustained battle against well-equipped forces."[68]

During this period, the Soviets also followed progress in American air assault tactics with great interest. By the late 1960s, the Soviets fielded a series of increasingly capable helicopters and began to see them as the preferred delivery means for tactical air-mechanized forces.[69] In

addition to air-mechanizing their airborne forces, the Soviets also created front-level air assault brigades each with two BMD-equipped infantry battalions.[70] These brigades worked in conjunction with operational maneuver groups to accomplish operational tasks in the depths of an enemy defense.[71] With demise of the Soviet Union and the deterioration of its successor states' militaries, it is unlikely that today even Russia could assemble the equipment and aircraft required for a brigade-sized air-mechanized operation. Nonetheless, it is worth noting that such conditions are not unreversible and under the terms of the Conventional Forces in Europe Treaty, Russia has admitted to having 7000 BMDs.[72]

Impressive though they were, the former Soviet Union's mechanized airborne divisions are not the force the United States requires to mount rapid, decisive offensive operations in the 21st Century. Their design fits the peculiar requirements of a doctrine for mass combined arms mechanized warfare firmly rooted in the Industrial Age. By the same token, neither the German nor the British models for air-mechanization are appropriate. While they add a modest measure of enhanced tactical mobility, these approaches fail to capitalize on the enormous potential of digitization and precision firepower. As a global power projection force, the Army must provide Joint Force Commanders with a new form of air-mechanization, one capable of operationally significant Precision Maneuver across strategic distances.

[1] "Knowledge and Speed," 3.
[2] "The Annual Report on The Army After Next Project to the Chief-of-Staff of the Army," (Washington, D.C.: Chief-of-Staff, U.S. Army, 1998), 2.
[3] "Army After Next (AAN) FY99 Tactical Excursions Final Report," (Fort Leavenworth, KS: Future Concepts Directorate, TRADOC Analysis Center, 1999), 9.
[4] Major James F. Holcomb, Jr. and Dr. Graham H. Turbeville, Jr., "Exploiting the Vertical Dimension: Continuing Development of the Soviet Desant Force Structure," (Fort Leavenworth, KS: Soviet Army Studies Office, 1987), 4.
[5] During a recent trip to Fort Hood, the author had the opportunity to tour the command posts of the 4th Infantry Division (Digitized). These facilities are tremendously impressive, but as the G-3 Operations Sergeant Major conceded when asked, they are also immobile! They will remain so until the Army is able to field information, communications, and power generation systems with sufficient capacity and capability to handle the enormous requirements of digitized command and control on the move.
[6] "The Annual Report on the Army After Next Project to the Chief-of-Staff of the Army," (Washington, D.C.: Chief-of-Staff, U.S. Army, 1998), 9.
[7] "Knowledge and Speed," 11.
[8] General Dr. F.M. Von Senger und Etterlin, "The Air-Mobile Divisions: Operational Reserves for NATO," *Journal of the Royal United Services Institute for Defence Studies* 132, no. 1 March (1987), 28.
[9] "Knowledge and Speed," 11.
[10] 1998 AAN Annual Report, 17.
[11] "Knowledge and Speed," 4. Among other places, this fact is well documented in the literature of the First World War. See for example John Keegan's account of how German soldiers defending on the Somme in 1916 adapted to life under the prolonged British artillery preparation fires. John Keegan, *The Face of Battle* (New York: The Viking Press, 1976), 231-234.
[12] "Knowledge and Speed," 5.
[13] 1998 AAN Annual Report, 9.
[14] Ibid.,10.
[15] Major Michael J. Kazmierski, "United States Army Power Projection in the 21st Century: The Conventional Airborne Force Must Be Modernized to Meet the Army's Strategic Force Requirements and the Nation's Future Threats" (MMAS Thesis, U.S. Army Command and General Staff College, 1990), 73-75.
[16] James J. Schneider, *The Structure of Strategic Revolution: Total War and the Rise of the Soviet Warfare State* (Novato CA: Presidio, 1994), 210-212.
[17] Mikhail Tukhachevsky, "New Problems in Warfare," in *AMSP Course 1 Foundations of Military Theory* (Fort Leavenworth, KS: School for Advanced Military Studies, U.S. Army Command and General Staff College, 1931 (1981 reprint)), 8.
[18] Ibid., 15.
[19] Ibid., 21.
[20] Ibid., 22.
[21] The story of Soviet efforts to produce a purpose-built armored fighting vehicle for air-mechanization operations in the years before World War II is very interesting. Dissatisfied with the T-27 tankette they had derived from the British three ton Carden-Llyod model, the Soviets turned to the American inventor Walter Christie. He developed and sold the Soviet Union an unwieldy prototype for a flying tank, the M-1932. Although he considered a rotary wing design, Christie settled on fixed wings instead. The Soviets also in experimented with slinging light tanks beneath bombers. See Kenneth Macksey and John H. Batchelor, *Tank: A History of the Armoured Fighting Vehicle* (New York: Ballantine Books, 1971), 66-67, 69-70, and 110.
[22] David M. Glantz and U.S. Army Command and General Staff College. Combat Studies Institute., *The Soviet Airborne Experience, Research survey / Combat Studies Institute, U S Army Command and General Staff College, no 4* (Fort Leavenworth, KS: Combat Studies Institute U.S. Army Command and General Staff College, 1984), 5.
[23] Ibid.,7.
[24] Ibid., 4 and 8-9.

[25] "Obituarty: Gen Ferdinand von Senger," *London Times*, 13 January 1987,
[26] General Dr. F.M. Von Senger und Etterlin, "New Operational Dimensions," *Journal of the Royal United Services Institute for Defence Studies* 128, no. 2 2 June (1983),11.
[27] Ibid.,12.
[28] Ibid.
[29] Ibid.
[30] Ibid.,13-15.
[31] "Obituarty: Brig Richard Simpkin," *London Times*, 4 November 1986,
[32] He also wrote *Antitank: An Airmechanized Response to Armored Threats in the 90s* (Oxford: Brassey's Publishers Limited, 1982), but despite its title it adds little to this analysis.
[33] Brigadier Richard Simpkin, "An Airmechanized Force for the 90s," *Armor* 90, no. 4 (1981),54. Italics in the original.
[34] Ibid., 56.
[35] Ibid.
[36] Brigadier Richard Simpkin, *Race to the Swift: Thoughts on Twenty-First Century Warfare* (London: Brassey's Defense Publishers, 1985), 121-122
[37] Ibid., 126.
[38] Ibid., 127.
[39] Ibid., 128.
[40] Ibid.
[41] Ibid., 128-129.
[42] Ibid.,157-158
[43] Ibid., 119-121.
[44] Macksey and Batchelor, 146.
[45] Peter Chamberlain and Chris Ellis, *British and American Tanks of World War II: The complete illustrated history of British, American, and Commonwealth tanks, gun motor carriages and special purpose vehicles, 1939-1945*, Second U.S. ed. (New York: Arco Publishing, Inc., 1969), 26.
[46] Macksey and Batchelor, 146.
[47] Major Charles A. Jarnot, "Air-Mech Strike," *Army* 50, no. 1 January (2000),26.
[48] Major Charles A. Jarnot, "Air Mech XXI: New Revolution in Maneuver Warfare" (MMAS Thesis, U.S. Army Command and General Staff College, 1996), 38. Jarnot contends the Germans have three of these brigades, but this is probably incorrect. The total German *Wiesel* purchase is only sufficient to support six airborne antitank battalions.
[49] Lieutenant Colonel Wolfgang Mettler, "The German Airborne Antitank Battalion and the Wiesel Armored Weapon Carrier," *Infantry* 85, no. 1 January-February (1995),26.
[50] R.M. Orgorkiewicz, "The MaK Wiesel: a Unique Air-Transportable Armoured Vehicle," *International Defense Review* 25, no. 6 June (1992),573-574.
[51] Mettler, 26.
[52] Jarnot, "Air Mech XXI," 38.
[53] Mettler, 26-27.
[54] Mettler, 27.
[55] Volker Löw, "The Airmobile Forces Command and 4th Division," *Military Technology* 21, no. 10 October (1997),65-67.
[56] Holcomb and Turbeville, 7.
[57] Quoted in Holcomb and Turbeville, 7. Emphasis in the original.
[58] Glantz, *The Soviet Airborne Experience*, 137-139.
[59] Dr. Graham H. Turbeville, Jr. "Soviet Desant Forces," (Fort Leavenworth, KS: Soviet Army Studies Office, 1988), 3.
[60] Macksey and Batchelor, 110. Until the fielded a suitable transport aircraft, the Soviets carried their ASU-57s in containers under the wings of Tu-4 bombers.
[61] Macksey and Batchelor, 1110.
[62] David Eschel, "Soviet Airborne Forces," *Military Technology* , no. July (1990),51.
[63] Colonel Wallace P. Franz, "Airmechanization: The Next Generation," *Military Review* 77, no. 2 February (1992),62.

[64] Major Michael J. Kazmierski, "United States Army Power Projection in the 21st Century: The Conventional Airborne Force Must Be Modernized to Meet the Army's Strategic Force Requirements and the Nation's Future Threats" (MMAS Thesis, U.S. Army Command and General Staff College, 1990), 44.
[65] Holcomb and Turbeville, 8-9.
[66] Eschel, 54; Macksey and Batchelor, 110 and James Kinnear, "Russian Armour Developments - Airborne AFVs (1950-93)," *Jane's Intelligence Review* 6, no. 3 March (1994). Since1970, the Soviets and then Russians have upgraded the basic BMD design at least twice and have also fielded derivative vehicles such as a personnel carrier, an air defense system, an armored recovery vehicle, a command and control vehicle, and the 2S9 self-propelled gun/mortar. Notably, the BMD-3 has the capability to be air-dropped with the crew INSIDE the vehicle! See the Kinnear article for details.
[67] Holcomb and Turbeville, 8-9.
[68] Eschel, 50.
[69] David M. Glantz and U.S. Army Command and General Staff College. Combat Studies Institute., *The Soviet airborne experience, Research survey / Combat Studies Institute, U S Army Command and General Staff College, no 4* (Fort Leavenworth, KS: Combat Studies Institute U.S. Army Command and General Staff College, 1984), 149-150.
[70] Glantz, *The Soviet Airborne Experience*, 154-155 and Holcomb and Turbeville, 13-15.
[71] Turbeville, 5. These units used organic heavy lift helicopters to deliver their BMDs and infantry. For example, the Mi-26 Halo can lift either 85 troops or two combat loaded BMDs.
[72] Christopher F. Foss, "New Russian Airborne Assault Vehicle," *Jane's Intelligence Review* 5, no. 5 May (1993),218.

CHAPTER THREE

From the Locust to Precision Maneuver: The Case for American Air-mechanization

> [In 2025] US forces will not be able to afford linear sequential campaigns that require discrete staging and phasing. To defeat this corrosive enemy of time, the operational level of war must be pushed toward the execution of near-simultaneous campaigns that, at the theater-operational level, will take on the characteristics of a coup de main.
>
> *The Army After Next Project Annual Report, 1997*[1]

Compared to its foreign counterparts, the U.S. Army has made little practical progress in air-mechanization. However, as the following pages will demonstrate, there is a significant American literature on air-mechanization and sufficient experimental evidence to enable the leap ahead required by Precision Firepower Military Technical Revolution-enabled defenses. The Army After Next Project, in particular, makes a compelling argument for developing an operationally significant Precision Maneuver force based upon the synthesis of precision firepower and air-mechanization.

Air-mechanization and the 20th Century U.S. Army

While the American Army of the last century never created an air-mechanized force, it nonetheless recognized the need for mobile protected firepower in vertical envelopment operations. Unfortunately, the Army's efforts to meet this requirement were often under-resourced and frequently frustrated by technological failures. During World War II, the Army fielded the M22 Locust, an eight ton vehicle designed and built to be an airborne light tank. America produced 830 of these vehicles, but they never saw action because the military did not have the gliders needed to land them.[2] The Army's next attempt to produce an airborne armored

vehicle began in 1957 when then Chief of Staff General Maxwell Taylor decided that the Army would develop a light tank to be shared by both airborne and cavalry units.[3] The product of this effort was the much maligned M-551 Sheridan Airborne Armored Reconnaissance Vehicle. The resulting prototype met the program's goals for protection and firepower, but exceeded the ten ton target weight by more than eight tons. Nonetheless, in 1966 the Army rushed it into production only to rapidly discover severe maintenance and reliability issues it was never able to adequately remedy.[4] In 1978, after only twelve years service, the Army withdrew the Sheridan from all units except the 82nd Airborne Division's tank battalion.[5] In the early 1990s after a number of false starts, the Army developed the Sheridan's replacement, the M-8 Armored Gun System. Just as this vehicle was about to go into production, a cash-strapped Army terminated the program in 1996.[6] In the meantime, the M-551 remained in service with the airborne tank battalion, but in the wake of the cancellation of the M-8 program the Army leadership also retired the Sheridan and disbanded that unit.[7]

While the Army experienced these difficulties finding an adequate armored fighting vehicle to support its paratroopers, it was also busy developing the doctrine, equipment, and organizations for vertical envelopment using helicopters. From the start, technological, operational, and institutional forces biased the development of air-mobility in favor of a light infantry and not an air-mechanized model. Early helicopters were unable to lift more than a few troops so experimentation gravitated toward light infantry insertion. This period also coincided with the Korean and Vietnamese Wars, two infantry-dominated conflicts fought in severely restricted terrain. Just as internal Army politics retarded mechanization in the 1930s, branch proponency shaped the development of air-mobility during the Cold War. Of the two maneuver arms, only Infantry showed any interest in using helicopters to maneuver ground-gaining forces.[8] Conflict between the Army and Air Force over roles, missions, and restrictions on the payload and air speed of Army aircraft further distorted experiments with air-mobility.[9]

As the Army's experience with helicopters increased, there was a corresponding increase in the quality and quantity of professional discourse about the role and potential of airmobile

maneuver. General James M. Gavin, the legendary wartime commander of the 82nd Airborne Division, made one of the most important contribution to this debate. In 1954, he published "Cavalry, and I Don't Mean Horses!" in the widely-read *Harper's Magazine.* Drawing on studies conducted while he was the Army G-3, Gavin argued for the creation of airmobile units for tactical maneuver. He described the cycle of ascendancy between firepower and maneuver and suggested that the firepower of nuclear weapons required a maneuver antidote. Gavin also justified air-mobility on the basis of his observation that armies needed an ultra-mobile element much as horse cavalry had provided the foot-mobile forces of the past. After the widespread mechanization and motorization of land forces in mid-century, Gavin argued that armies no longer possessed the required ultra-mobile force. In his opinion, airmobile troops could fill that void.[10]

In the early 1960s the Army's experimentation with air-mobility reached it zenith with the formation of the 11th Air Assault Division (test) and the Army Tactical Mobility Requirements Board — more commonly known as the Howze Board after it chairman, General Hamilton Howze. In its final report, the Howze Board called for the conversion of five of the Army and Marine Corps' twenty-six divisions to the air assault model. As the commander of the test division recognized, helicopters made it possible for the division to rapidly mass across wide distances and operate largely independent of the terrain below them.[11] This mobility seemed a perfect fit for an Army that faced the challenge of preparing for an atomic battlefield and counterinsurgency simultaneously.

This period also produced one of the most forward looking American articles on air-mobility. In the September 1965 issue of *Military Review*, Colonel Robert B. Rigg made an argument for what he termed "kinestatic warfare." The author described a vision of Precision Maneuver based on the synergy of air-mechanized maneuver and rapid target acquisition and servicing.[12] In his article, Rigg envisioned an air maneuver corps operating within a field army. Its primary task was to strike targets deep in the enemy rear to aid the advance of more conventional close combat forces.[13] To strike the enemy at operational depths, he argued that

such a force required "second-wind mobility" so it could continue to move and strike once landed.[14] Rigg offered the opinion that such a "kinestatic" force would provide the leap ahead that would render the Soviet's advantage in conventional forces irrelevant.[15] In a prescient passage, the author provided a glimpse of future war seemingly lifted from an Army After Next report:

> Some future army is going to fight with certain portions of its men in swarms of low-flying aircraft, leaping the traditional terrain and man-made barriers to arrive at multiple points of its own choosing, departing from these destructive scenes to sweep and swarm in order to create others. This will be kinestatic warfare, four-dimensional combat of a swift and violent nature that will see military forces embrace a country or continent within a short capsule of time.[16]

In the following decade, the Army honed its skills in infantry air-mobility in the mountains and paddies of Vietnam while the Soviets air-mechanized seven airborne divisions. In the wake of that war, the Army refocused on high-intensity conventional operations in Europe. Observers quickly recognized the threat this new Soviet capability posed, especially to the oil fields of the Middle East. By 1980, military writers began to clamor for a similar American capability. That year two American generals published a journal article arguing for the creation of a "light armored corps with thousands of light armored vehicles that can be transported in existing aircraft" to counter the threat posed by Soviet mechanized airborne forces.[17] The authors envisioned a joint strategic corps equipped with air-transportable, amphibious, armored fighting vehicles. Their design for this corps combined two Marine divisions with a partially mechanized airborne division and a light armored division.[18] While nothing came of this proposal, it shows how knowledge of Soviet air-mechanization caused American officers to examine the potential of vertical envelopment with a mobile protected force.

In the final years of the Cold War, students at the Army's School for Advanced Military Studies (SAMS) and Command and General Staff Officer's Course (CGSOC) produced a number of monographs and theses that called for some form of air-mechanization. Like the proposal for a light armored corps above, many of these authors justified their arguments for air-mechanization on the basis of countering a real or perceived Soviet advantage. In each case, the writings of

Simpkin, von Senger, and to a lesser extent, Tukhachevsky informed these students' views on the possibilities of air-mechanization. Major George S. Webb's 1986 SAMS monograph was the first of these publications. It argued that an air-mechanized division was the operational reserve needed to assure the successful defense of the NATO center. He contended that only air-mechanization would afford the necessary advantage in mass and mobility required for such a mission.[19]

Two years later, Major Darrell E. Crawford, another SAMS student, used one of his monographs to argue that Army aviation was moving toward air-mechanization. He equated air-mechanization with Union General James H. Wilson's devastating cavalry raids in the Western Theater of the American Civil War. Crawford asserted that whenever innovators combined a supporting mobility system (the horse or helicopter) with a primary fighting system (the rifleman or armored fighting vehicle) the result was an increase in mobility and firepower that enabled decisive independent operations.[20] He concluded that all the Army needed to do to realize the benefits of air-mechanization was to determine the proper "track/rotor interface" and then build "a force of substantial size and with the equipment necessary for decisive effects."[21] To that end, Crawford proposed forming corps-level air-mechanized brigades combining five attack helicopter battalions, three heavy lift helicopter battalions, a three battalion light armored regiment, and a Multiple Launch Rocket System (MLRS) battery.[22]

1990 saw Command and General Staff College students complete three monographs or theses on air-mechanization. Major Michael J. Kazmierski's thesis lamented the impotency of American airborne forces when compared to their BMD-equipped Soviet counterparts. His solution was to buy a similar vehicle.[23] Major Michael T. Inman's monograph studied and rejected the idea of an air-mechanized force based on helicopter-delivered light armored fighting vehicles. The author asserted that the U.S. had no suitable aircraft and if it did such a formation would be logistically unsupportable anyway. Inman argued that the AH-64 Apache Attack Helicopter was the realization of von Senger's dream of an MABV. He concluded therefore the Army's existing Apache-rich air assault division was the realization of air-mechanization.[24]

Major William M. Jacobs monograph proposed enlarging the corps aviation brigade to create a massive aviation division. He suggested these divisions include two attack helicopter brigades, an M-8-equipped light armored brigade, an artillery brigade, and two supporting lift aviation brigades.[25] Jacobs envisioned the role of the light armored brigade as seizing and holding terrain in support of the attack helicopters and their supporting artillery.[26]

The Cold War's end created a climate conducive to innovative thinking and saw the emergence of two of the most important contributors to the American literature of air-mechanization. First, Colonel Wallace P. Franz offered a synthesis of older ideas in the widely read journal *Military Review*. Then, Major Charles A. Jarnot produced an important new departure that presaged air-mechanization as one finds it in the Army After Next Project.[27]

In 1992, Franz published the article "Airmechanization: The Next Generation." Liberally citing von Senger and Simpkin, Franz repeated many of the arguments for air-mechanization made throughout the 1980s. He suggested that the evolution of the helicopter would parallel that of the tank. It would change from a combat support platform, like World War I tanks, to the centerpiece of a formation capable of independent operational employment, like tanks in modern mechanized forces.[28] Borrowing heavily from von Senger, Franz called for the creation of an "air/land vehicle" that combined "the operational mobility of the helicopter with the tactical mobility of the tank."[29] He suggested it would be feasible to produce such a vehicle in the eleven ton range by the end of the 1990s.[30] Franz contended air-mechanization would enable a smaller, lighter force to defeat heavy mechanized forces.[31] He described an operational concept approaching Precision Maneuver, writing that "maneuver-based concepts plus technology can combine to produce the capability to destroy armies before they are deployed for combat — the large-scale ambush conducted by a major air-mechanized force to achieve operational objectives."[32]

Jarnot's 1996 thesis, later repackaged as another *Military Review* article, produced the first distinctly American interpretation of air-mechanization and the first call for Precision Maneuver. After surveying the literature of the topic, the author described an "Air Mech XXI" force

combining the tools of digitization, precision firepower, and air-mechanization. Recognizing that the Precision Firepower Military Technical Revolution was altering the relationship between fire and maneuver, Jarnot designed an organization in which maneuver supported precision fires.[33] His proposed division included a single air-mechanized maneuver brigade, a strike brigade composed of attack aviation and rocket artillery units, and a division support brigade. Notably, each brigade was capable of moving using only its organic lift aviation.[34] In the resulting organization, the role of the air-mechanized force was to provide "the close terrain combat force missing in pure attack helicopter operations and the ground mobility, protection, and firepower missing in light infantry units."[35]

American Air-mechanization for the 21st Century: The Army After Next Project Makes the Case

> The restoration of the offensive as the dominant form of war will come with the appearance of a fourth cycle of warfare, a cycle defined more by the new revolution in information rather than the stale remnants of the machine age. Imagine a maneuver force possessing the ability to see with unprecedented clarity, to anticipate with unparalleled sureness, to accelerate the pace of movement with unequalled velocity and to maintain an unrelenting operational tempo. Such a force would be able to traverse the killing ground, however expansive and lethal, relatively untouched and decide the campaign with a violent and debilitating movement that ends quickly with minimum loss to all sides.
>
> *The Army After Next Project Annual Report, 1997*[36]

With the notable exceptions of the work of Rigg and Jarnot, American advocates of air-mechanization have fixated on evolutionary change within the prevailing paradigms of combined arms mechanized and airborne warfare. Flying tanks and mechanized airborne infantry may use vertical envelopment to attain a positional advantage, but their orientation on the direct fire battle anchors them in the Industrial Age. The Precision Firepower Military Technical Revolution is changing the nature of modern war, diminishing the importance of the direct fire close battle in favor of tactical and operational precision indirect fires. As suggested by Jarnot's writing, Army

After Next experimentation has found that the future belongs to Precision Maneuver, the synthesis of vertical envelopment, digitization, and precision firepower.

As its name suggests, the Army After Next Project is the institution's attempt to look beyond the "next Army," the digitized force of Army XXI. When the former Army Chief of Staff, General Dennis Reimer, established AAN in February 1996, he charged it with looking back from 2025 "to assist our leadership in developing a vision of future Army requirements."[37] AAN's primary means to that end was a series of free-play wargames encompassing all three levels of war.[38] From the start, AAN worked from the assumption that the Army's efforts to enhance combat power through digitization would succeed. Thus, AAN presumed that by 2010 the Army XXI force design will create a "knowledge-based force...possessed with a clarity of observation, degree of decentralization, and pace of decision-making unparalleled in the history of warfare."[39] With information dominance assured, the focus of AAN force design became providing "the physical speed and agility to complement the mental agility inherited from Force XXI."[40]

AAN studies explained this requirement for physical speed and agility by explicitly recognizing the Precision Firepower MTR and the advantages it affords a defending force. The first AAN annual report directly linked the ascendancy of the defense to the advent of deep attack weapons during the Cold War. It argued that "long-range precision firepower systems will maintain the defensive as the dominant form of warfare."[41] "To restore the advantage to the offensive," it continued:

> We believe that the Army must devise the means to accelerate the speed of movement across the deadly zone by an order of magnitude or greater. The union of knowledge and speed will do more than increase linear velocity, it will also quicken a commander's ability to divine and exploit an enemy's weakness and to offset the influence of chance and uncertainty.[42]

It found a solution in air maneuver units able to "exploit terrain by maneuvering for tactical advantage within the folds and undulations of the earth's surface without suffering the restrictions imposed on mobility by contact with the ground."[43]

This demand for speed through air maneuver has implications that transcend the tactical and operational levels of war. The Fiscal Year (FY) 1998 Annual Report concluded that, "one of the most important insights of the Army After Next project is that *strategic preclusion* and rapid *strategic maneuver* must form the core concepts for the future joint force."[44] It defined "strategic preclusion" as "the idea of moving so fast and with such lethality that enemies cannot 'set' forces and operate at advantage."[45] It established "strategic maneuver" as the "rapid movement over global distances of highly lethal air, land, sea and space capabilities to converge with overwhelming power upon the enemy center of gravity and then cause the disintegration of the opponent."[46] Land combat forces with conventional forms of mobility cannot accomplish these tasks. They demand an air-mechanized force with some capability to self-deploy from the Continental United States (CONUS) directly into a theater of war without time-consuming reception, staging, and onward movement requirements.

In light of the importance of speed and mobility, air-mechanization has become a central part of the AAN Project's vision of future American war making. From the start, the requirement for a quantum increase in the speed and agility of maneuver forces to overcome the effects of the Precision Firepower Military Technical Revolution drove the project toward an air-mechanized solution. During the fall of 1996, AAN experimentation began with tactical wargames at Fort Leavenworth. Their purpose was to explore what an air-mechanized force might look like and be capable of in the 2025 time frame.[47] It modeled a blue air-mechanized "battle force" with an operational reach of 1500 kilometers. This formation defeated its enemy by Precision Maneuver induced Cybershock. As the FY97 AAN Annual Report stated, the battle force aimed not "to kill so much as to paralyze, to exploit the ability to maintain a constant advantage of position in order to close an enemy's options, wear him down, and eventually collapse his will."[48] It accomplished this through vertical envelopment into the flanks and rear of enemy units. From these landing zones, the battle force maneuvered on the surface into positions from which it launched multiple near simultaneous precision indirect fire ambushes. The net effect of these ambushes was to create a "single simultaneous act of overwhelming fire and maneuver" that devastated the

targeted enemy force.[49] In the simulation, this tactic proved so effective that it rapidly swept the enemy from the open terrain, forcing him into complex terrain and asymmetric tactics.[50]

The FY97 Winter Wargame aimed to model the strategic environment and the mix of Army forces available to a Joint Force Commander in 2025. The scenario placed special operations forces and a forward deployed Army XXI deterrent force in theater as the war began. An air-mechanized rapid reaction force self-deployed from CONUS, arriving in theater ready to fight within forty-eight hours. Additional Army XXI forces from CONUS arrived much later to crown the victory and serve as a hedge against a long war. While the air-mechanized force's rapid deployment created an effective and successful preclusion force, the wargame report concluded that the rapid reaction force would be at risk if supporting CONUS-based units were unable to reinforce it within two weeks. The air-mechanized force also demonstrated the virtue of its ability to deploy to distributed locations in theater, thus neutralizing the threat of red weapons of mass effects launched against staging bases.[51]

Recognizing that the previous year's tactical wargame had created only a rough concept of an air-mechanized battle force and its operational employment, the FY98 Tactical Wargame focused on increasing the resolution of that unit.[52] The Army's research laboratories scrutinized all the systems projected for this unit beforehand. As the exercise's final report emphasized, these systems "had to meet a clear and rigorous test: could they be designed and fielded in 2025, given the state of today's technology and the proposed state of technology in 2025?"[53] More experienced players and a more detailed and sophisticated simulation also helped the second tactical wargame gain a greater understanding of the proposed air-mechanized battle force.[54] The design of that force appears in Figure 8.

It is worth pausing for a moment to examine the weapons that the Army's scientists believe will be available to an objective air-mechanized force. Its "battle teams," the organizational equivalent of today's platoons, each employed three fifteen ton Advanced Fighting Vehicles (AFVs). These vehicles mounted a 20mm automatic cannon and four missiles for direct fire engagements as well as two missiles for precision indirect fires. To enhance their protection, the

AFVs possessed an active protection system to defeat inbound shaped-charge projectiles. An Advanced Robotic Engagement System carrying sixteen multi-purpose guided missiles trailed each AFV and served as the team's major source of precision fires.[55] Finally, the labs believed that battle team's vehicles would be capable of moving cross-country at forty miles per hour and have a 600 mile or eight hour operational envelope. A key challenge of any effort to create an initial air-mechanized force will be finding extant systems that approximate the capabilities described above.

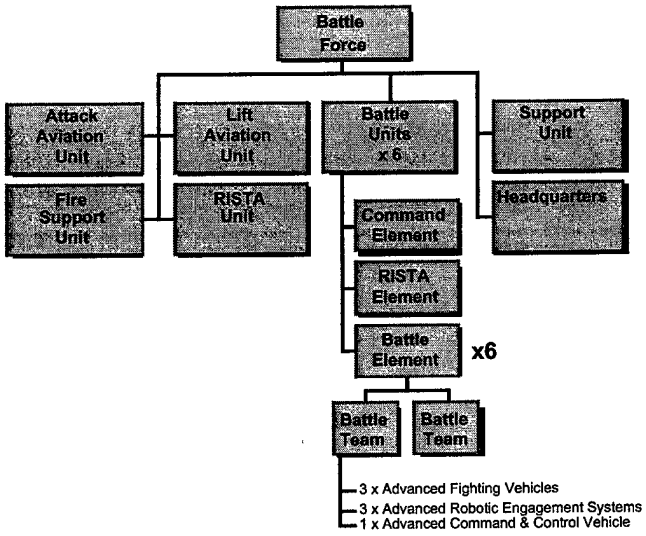

Figure 8 The Blue Air-mechanized Battle Force modeled in the FY98 Tactical Wargame. TRADOC Analysis Center, "Army After Next FY98 Tactical Wargame Final Report," (Fort Leavenworth, KS: 1998), slide 11.

The employment of these air-mechanized battle forces in the FY98 Tactical Wargame suggests some interesting capabilities and qualities of Precision Maneuver units. After deploying to theater, the battle force inserted its subordinate battle units 300 to 500 kilometers from their staging bases and within forty kilometers of their targets. Battle elements conducted precision ambushes at a range of about thirty-five kilometers then closed with the enemy in a brief direct fire fight. Interestingly, the defeat of an enemy division usually required only three battle units.[56] Finally, it should come as no surprise that the game found a formation designed for Information

Age warfare heavily dependant on the capabilities of its large reconnaissance, intelligence, surveillance, and target acquisition (RISTA) and communications elements.[57]

By the FY98 Spring Wargame at Carlisle Barracks, the Red commanders had learned to frustrate Blue plans by designing campaigns that conceded the air-mechanized battle force's dominance on open terrain. They chose to neutralize the battle force's strengths by hunkering down in urban areas where Precision Maneuver is much harder to achieve. The game's final report noted, "previous wargames tended to demonstrate advantages of the current air-mechanized concept, while the Spring Wargame tended to demonstrate limitations."[58] The authors' assessment of is summarized below:

Advantages	Limitations
• Global Self-deployment	• Inability to Fight in Urban Terrain
• Vertical Maneuver	• Inability to Hold Ground
• Precision Fire	• Vulnerability to Enemy Air Defense

The report's sobering conclusion was that air-mechanization alone was not the solution to the challenges of war in 2025. The authors suggested that AAN "develop and examine other concepts for its future forces."[59] They suggested a combination of maritime pre-positioning, forward deployment, and ultra-fast sea lift with a more responsive heavy force would be necessary to offset the limitations of an air-mechanized battle force.[60] This conclusion seems to overlook the strategic construct established in the first Winter Wargame. This student of air-mechanization in the Army After Next Project can find no evidence that suggests that it ever contemplated anything except a mix of ground and air maneuver forces with complementary capabilities and limitations. Such a force mixture is essential to the Army's ability to conduct operations across the full spectrum of conflict and potential environments. Indeed the Objective Force outlined in Army Chief of Staff General Eric K. Shinseki's transformation program is optimized for combat in the very environments where a air-mechanized Precision Maneuver battle force would be least effective.

In light of these facts, the AAN Project has continued to refine the concept and requirements for an air-mechanized battle force. The FY99 AAN Tactical Excursion compared different designs for the air-mechanized battle force.[61] One was an "airmobile" design combining a twenty ton Future Combat Vehicles (FCVs) and the Advanced Theater Transport (ATT). This fixed-wing aircraft is the planned replacement for the C-130 family of transports. The Department of Defense projects the ATT will be able to penetrate denied airspace to deliver a 40 ton payload on short, unimproved airstrips.[62] The alternative "air assault" design combined a lighter eight ton FCV and the Joint Transport Rotorcraft (JTR). This will be a vertical take off and landing aircraft able to lift a comparable payload. The Army expects the JTR to replace its CH-47 Chinook helicopters.[63] While it may use tilt-wing or tilt rotor technologies, it is equally likely to be a compound helicopter with rotors that retract to allow for high speed fixed wing flight.[64]

The FY99 Tactical Excursion confirmed the impressive capabilities an air-mechanized force would bring to future battlefields and found the "air assault" model best suited for AAN operations. Since it was able to make use of more potential landing site, the JTR-based model provided more flexibility and allowed more aggressive use of the battle force. Its ability to conduct tactical vertical envelopment made it possible to achieve positional advantages that would otherwise have been lost. The final report noted that the game showed that these advantages enabled and facilitated "the rapid generation of overwhelming combat power on the ground."[65] It concluded that "air mechanized ... forces with either lift capability [JTR or ATT] present powerful options to the operational commander that ground-bound forces do not offer."[66]

Having established that Precision Maneuver by air-mechanized forces represents a powerful capability needed in future offensive operations, the AAN Project has recently shifted its focus to proposing where such a capability should reside within the Total Force. The FY00 AAN Objective Force Design attempts to answer that question in light of the aforementioned Army Transformation Plan. Its medium weight force will ultimately replace the Force XXI design as the Army's main body.[67] Force design documents propose a CONUS-based Strategic

Response Corps with two divisions.[68] (See Figure 9) The objective "Air Maneuver Division" organization includes 12,900 troops, 480 JTRs and 556 FCVs. (See Figure 10) It employs six maneuver regiments with supporting rocket artillery, attack aviation, lift aviation, reconnaissance, and combat service support regiments under division control. The division's organic aircraft will enable it to self-deploy multiple regiments and a division command and control slice without augmentation.[69]

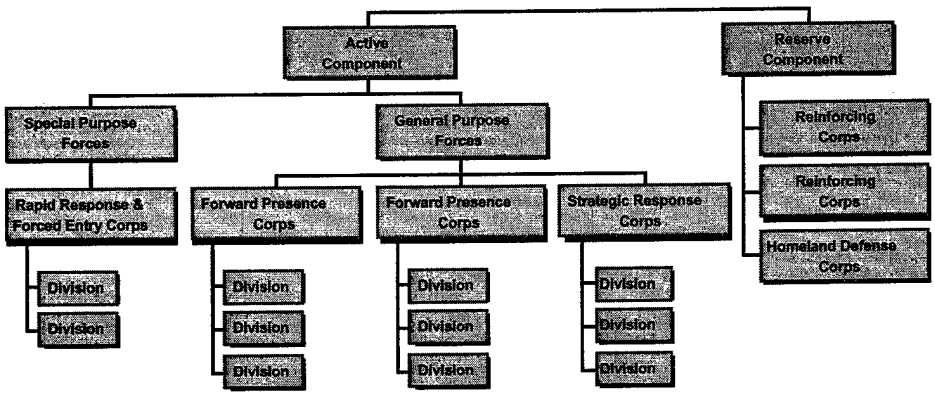

Figure 9 FY00 Objective Force Proposal. Deputy Chief of Staff for Doctrine Futures Directorate, *Army After Next FY00 Objective Force Design Proposals* [Presentation] (U.S. Army Training and Doctrine Command, 29 November 1999, slide 7.

Without question, the Army is on a path that will lead it to forming air-mechanized

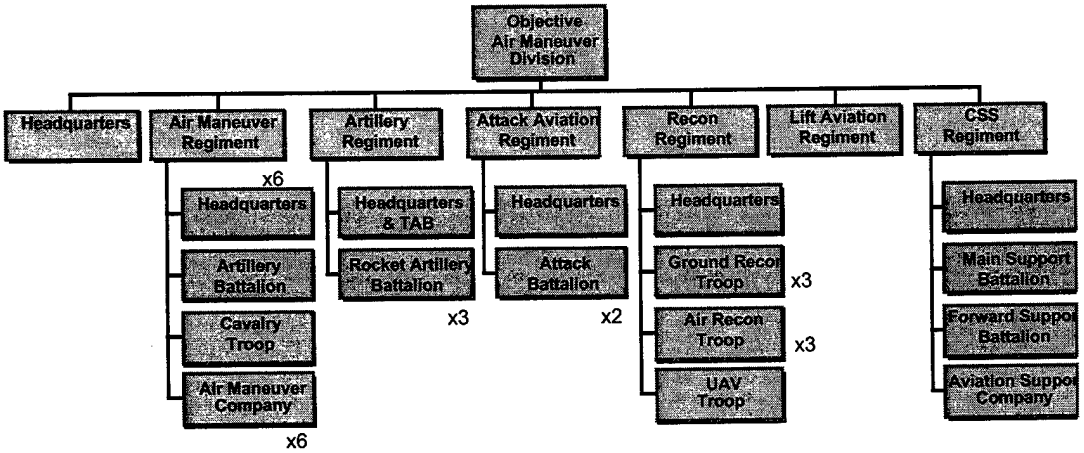

Figure 10 FY00 Objective Air Maneuver Division Proposal. Deputy Chief of Staff for Doctrine Futures Directorate, *Army After Next FY00 Objective Force Design Proposals* [Presentation] (U.S. Army Training and Doctrine Command, 29 November 1999, slide 18.

[1] "Knowledge and Speed," 20.
[2] The M-22 could be slung under a C-54 Skymaster transport, but this required the removal of the tank's turret. The British, who had the required heavy gliders, used a small number of M22s when they crossed the Rhine River in 1945. See Chamberlain and Ellis, 98-99.
[3] Dr. Robert Cameron, "American Tank Development During the Cold War," *Armor* CVII, no. 4 (July-August) (1998),33.
[4] Consider the author's personal experience with the Sheridan. During the summer of 1985, he participated in a two week exercise as a member of B Company, 3-73 Armor (Airborne). On any given day of this exercise, only a handful of B Company's seventeen Sheridan actually operated.
[5] Cameron, 34-35 and *M551A1 Armored Reconnaissance Airborne Assault Vehicle (Sheridan)* [WWW page] (Federation of American Scientists, 12 September 1998 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/m551a1.htm.
[6] *M8 Armored Gun System* [WWW page] (Federation of American Scientists, 2 August 1999 1999 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/m8-1gs.htm.
[7] Cameron, 34-35 and *M551A1 Armored Reconnaissance Airborne Assault Vehicle (Sheridan)* [WWW page] (Federation of American Scientists, 12 September 1998 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/m551a1.htm.
[8] Armor's interest in helicopters lay in their ability to perform reconnaissance and much later in the ability to deliver anti-tank fires.
[9] Jarnot, "Air Mech XXI," 32-33.
[10] Christopher C.S. Cheng, *Air Mobility: The Development of a Doctrine* (Westport, CT: Praeger, 1994), 69.
[11] Cheng, 178-180 and Major Darrell E. Crawford, "Airmechanization: Determining Its Tactical Viability on the Battlefield" (U.S. Army Command and General Staff College, 1988), 9-10.
[12] Colonel Robert B. Rigg, "Kinesthetic Warfare: Mode for the Future," *Military Review* 65, no. 9 (September) (1965),13-14.
[13] Ibid.,14-15.
[14] Ibid.,17.
[15] Ibid.,16.
[16] Ibid.,19.
[17] Lieutenant General James F. Hollingsworth and Major General Allan T. Wood, "The Light Armored Corps - A Strategic Necessity," *Armed Forces Journal International* 117, no. 5 January (1980), 20.
[18] Ibid., 21.
[19] Major George S. Webb, "Prescription for the Counterstroke: The Airmechanized Division at the Operational Level of War" (U.S. Army Command and General Staff College, 1986).
[20] Crawford, 10-11.
[21] Ibid., 7-8.
[22] Ibid., 14-15. Crawford suggested the light armored regiment consist of a mechanized infantry battalion in modified and lightened M-2 Bradley Fighting Vehicles and two armored battalions armed with the 105mm variant of the Cadillac Gauge Stingray armored car.
[23] Kazmierski,130, B-1.
[24] Major Michael T. Inman, "Operational Maneuver in the 90's: Is Army Aviation a Viable Option?" (U.S. Army Command and General Staff College, 1990), 31-32.
[25] Major William M. Jacobs, "Massing The Third Dimension In AirLand Battle-Future: The Aviation Division" (U.S. Army Command and General Staff College, 1990), 28.
[26] Ibid., 30-31.
[27] The link between Jarnot's writings and the Army After Next Project is Brigadier General (retired) Huba Wass de Czege. As a student at the Command and General Staff College, Jarnot heard Wass de Czege's vision of future war and sought the latter's help in preparing his thesis. Wass de Czege has also been a key participant in the AAN process. Major Charles A. Jarnot, Conversation with the author, 18 January 2000, Fort Leavenworth, Kansas.
[28] Franz, 62.
[29] Ibid., 64.

[30] Ibid., 65.
[31] Ibid., 59.
[32] Ibid., 66.
[33] Jarnot, "Air Mech XXI," 64.
[34] Ibid., 67.
[35] Ibid., 63.
[36] "Knowledge and Speed," A-4.
[37] Ibid., Chief of Staff Memo dtd 1 August 1997.
[38] Ibid., 2.
[39] Ibid., 1.
[40] Ibid.
[41] Ibid., 2.
[42] Ibid., 2-3.
[43] Ibid., 18.
[44] 1998 AAN Annual Report, 3. Emphasis in the original.
[45] Ibid.
[46] Ibid.
[47] "Knowledge and Speed," B-3.
[48] Ibid., A-5.
[49] Ibid.,13.
[50] Ibid.,14. See also TRADOC Analysis Center, "Army After Next FY98 Tactical Wargame Final Report," (Fort Leavenworth, KS: 1998), slide 15.
[51] Ibid., 14-16.
[52] FY98 Tactical Wargame Final Report," slide 2a.
[53] Ibid., slide 3.
[54] FY98 Tactical Wargame Final Report," slide 3.
[55] Ibid., slide 11a.
[56] Ibid., slide 15
[57] Ibid., slides 18 and 18a.
[58] Walter L. Perry, Bruce R. Pirate, and John V. Gordon, IV, "Issues Raised during the Army After Next Spring Wargame," (Santa Monica, CA: RAND Arroyo Center, 1998), xiv.
[59] Ibid., xiv.
[60] Ibid., 18.
[61] "Army After Next (AAN) FY99 Tactical Excursions Final Report," (Fort Leavenworth, KS: Future Concepts Directorate, TRADOC Analysis Center, 1999), 1.
[62] *Lockheed Martin Aeronautical Systems Air Mobility Programs* [PowerPoint Presentation] (Lockheed Martin, [cited 2000]).and *A DSB White Paper: A Low Observable Theater Transport to Supplement the C-130J* [MS Word Document] (Lockheed Martin, [cited 2000]).
[63] Scott R. Gourley, "JTR to be 'Chinook' for US Army of 2025," *Jane's Defense Weekly* 28, no. 10 September (1997), 58-59 and "The Joint Transport Rotorcraft," *Army* 48, no. 1 January (1998), 53-54.
[64] For an example of how this technology might be applied to the JTR see Major Charles A. Jarnot, *Air-Mech-Strike: New Maneuver & Force Structure for the 21st Century U.S. Army* [Powerpoint Presentation] (1999), slides 60-68.
[65] FY99 Tactical Excursions Final Report, 6.
[66] Ibid., 22.
[67] Major General James M. Dubik, Deputy Commanding General for Transformation, TRADOC, comments in response to the author's question during his address to Advanced Military Studies Program, School for Advanced Military Studies, U.S. Army Command and General Staff College, (Fort Leavenworth, Kansas, 12 April 2000).
[68] Deputy Chief of Staff for Doctrine Futures Directorate, *Army After Next FY00 Objective Force Design Proposals* [Presentation] (U.S. Army Training and Doctrine Command, 29 November 1999 [cited).slide 7.
[69] Ibid., slides 17-18.

CHAPTER FOUR

Realizing Operational Precision Maneuver: Re-inventing the XVIII Airborne Corps

> The Army has the world's finest light infantry, but it lacks adequate lethality, survivability, and mobility once in theater in some scenarios.
>
> General Eric K. Shinseki, Chief of Staff[1]

> To see some variant of the AAN era force posture deployed within 25 years, the Army will have to seriously consider the intermediate transition process.
>
> John Gordon IV and Peter A. Wilson[2]

In the first *Army* issue of the 21st Century, Major Charles Jarnot repeated his plea for Precision Maneuver or what he terms "Air-Mech Strike." He suggested that:

> What the U.S. Army can do that no other army has done to date is combine its large fleet of helicopters with a modest purchase of off-the-shelf helicopter-transportable armored vehicles, digitize them, arm them with precision munitions and finally realize the dreams of vertical envelopment theorists like Generals Gavin, Howze, Galvin, Moore and Wass de Czege.[3]

Seizing upon the most pressing issue before the Army, Jarnot argued that air-mechanization is a natural fit with General Shinseki's vision for transforming the force to increase its relevance and responsiveness. He recommended that one of the two Initial Brigade Combat Teams become a test bed for developing the tools for Air-Mech Strike.[4] Unfortunately, the focus of the transformation effort lies elsewhere. As Major General James M. Dubik, the leader of this effort recently explained, these "medium weight" forces will comprise the Army general purpose forces in the coming half-century.[5]

This begs the question, when will the Army begin the transformation of its special purpose forces? As the *Army After Next FY00 Objective Force Design Proposals* show, the consensus is that the rapid reaction corps, the XVIII Airborne Corps, should be an air-mechanized Precision Maneuver unit. Given these facts, it seems prudent that the Army develop an axis within its transformation plan that moves the corps in this direction. As Brigadier General Huba Wass de

Czege once observed, there is a fine art to changing an army while preserving its current capabilities.[6] The Army must resist the temptation to delay changes to this corps for fear of degrading its immediate utility. It should take advantage of existing programs and extant technologies to begin transforming the XVIII Airborne Corps into an operationally significant Precision Maneuver force. In this way, the corps will be able to retain much of its current capabilities while simultaneously refining the operational concepts, tactics, techniques, procedures, and equipment requirements needed to advance its eventual air-mechanization.

Two caveats are in order before delving too deeply into a hypothetical initial Precision Maneuver rapid reaction corps' design. The purpose of this chapter is not to prescribe the specific tables of organization or systems for the initial corps. The complexities of the force design and procurement environments would make it presumptuous to do so from a comfortable seat in the military academe. Nor is it within the scope of this proposal to specify the organization of battalion-sized or smaller units. That is a task for those with whose expertise exceeds this author's limited experience.[7] Rather, this chapter simply aims to suggest a broad framework for creating the initial precision maneuver rapid reaction corps by 2010 and the technologies it may employ.

The following assumptions and principles guide this proposal:

- To be feasible by 2010, the initial rapid reaction corps must use off-the-shelf technologies. The corps' design must also maximize the use of systems already available in the Army inventory. These will be sufficient to build the operational experience and requirements necessary to guide procurement of the systems required by later interim and objective corps force designs.
- Just as the Army Transformation Plan presumes the success of Army XXI, digitization will necessarily form the cornerstone of any effort to fashion a Precision Maneuver force. This system of information collection, processing, and dissemination systems must deliver dramatic improvements in situational awareness and enable significant increases in force efficiency.

- The availability and capabilities of the strategic airlift available to move a rapid reaction corps will not be significantly different from what is available today.
- Any initial Precision Maneuver force should replicate to the extent technologically feasible, the capabilities AAN projected to be available to an objective air-mechanized battle force.
- The initial rapid reaction corps' organization should mirror as closely as possible the design in the *Army After Next FY00 Objective Force Design Proposals*. However, to minimize organizational turbulence during the initial phase of the transformation of the XVIII Airborne Corps, it would be advantageous to retain the prevailing triangular divisions and hierarchy of subordinate headquarters.
- It is in the Army's interest to retain the capability to conduct up to brigade-sized parachute and airmobile assaults with dismounted infantry. These forces will remain useful in forced entry operations, especially in complex terrain.
- Just as the Army Transformation Plan aims to standardize the organization of general purpose forces, any redesign of the XVIII Airborne Corps should create multiple subordinate divisions of a single type. These forces must be able to cycle through the various readiness postures with minimal changes to either war plans or the enabling support and transportation arrangements.
- The lift aviation assets of the subordinate divisions must be centralized under division control for reasons of efficiency, just as they are in the current air assault division. Later iterations of the corps and division design should begin decentralizing aviation to create brigades capable of independent operations with organic aircraft.

Figure 11 shows a proposed organization for the initial rapid reaction Precision Maneuver Corps. Its key characteristics are the deletion of a heavy mechanized division, the replacement of the specialized airborne and air assault divisions with a single type air maneuver division and the reorganization of the corps troops as regiments within functional brigades. The corps includes an air-mechanized cavalry regiment for economy of force operations and as a hedge against failures

of information dominance in the close battle. The corps' lift aviation regiment provides the aircraft needed to move corps troops as required by the campaign. The size of the unit could be scaled over time to give the corps the ability to move itself over operational distances using only organic aircraft.

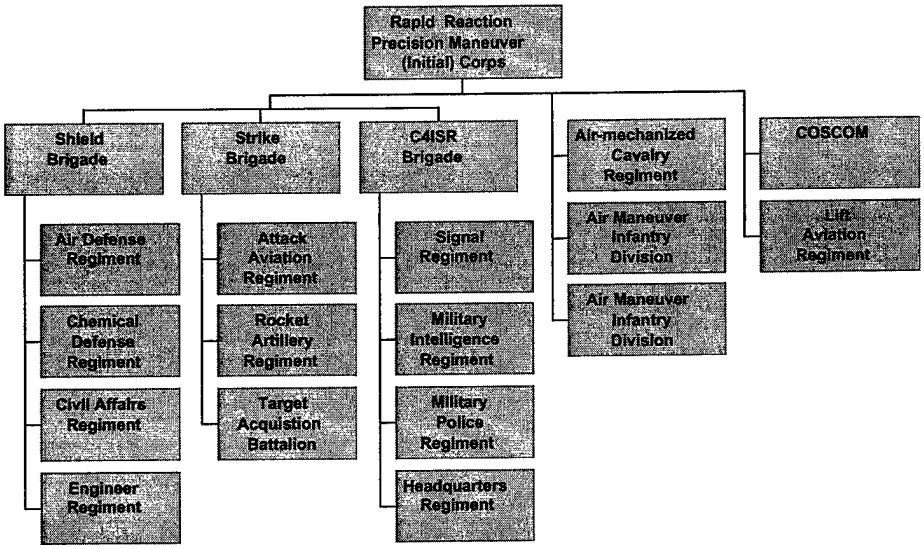

Figure 11 Proposed Initial Precision Maneuver Rapid Reaction Corps Design

Figure 12 depicts the organization of the initial air maneuver division. It dramatically increases the division's ability to conduct deep or shaping operations while preserving a significant maneuver force for the close battle. One of the subordinate air maneuver brigades would be trained to conduct airborne operations in addition to its normal heliborne operations. Each of the maneuver brigades includes an organic direct support howitzer battalion. The division artillery reforms into a three battalion rocket artillery regiment optimized to deliver long range precision fires in conjunction with shaping operations by the attack aviation regiment's two attack helicopter battalions. An enlarged reconnaissance regiment replaces the division cavalry squadron and refocuses on reconnaissance tasks in support of division shaping operations instead of reconnaissance and security in the close fight. Like its counterpart at corps, the division lift

aviation regiment provides the aircraft required for the division to move tactically by air. It too would be scaled over time to increase the division's mobility with organic aircraft.

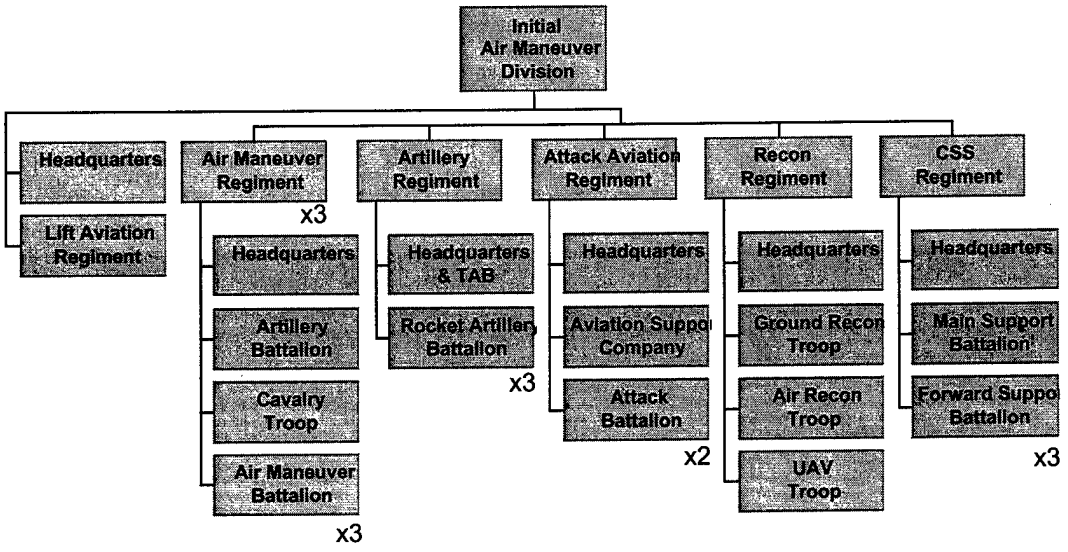

Figure 12 Proposed Initial Air Maneuver Division Organization

Recognizing the wealth of off-the-shelf systems available today is the key to moving beyond line and block charts toward realizing an operational Precision Maneuver capability. These systems fall within four broad categories: aircraft, air-transportable armored fighting vehicles, active protections systems, and precision weapons. Analysis of these categories suggests that the initial corps design can achieve enhanced mobility with the UH-60L and a family of light armored fighting vehicles derived from the German *Wiesel.*

The U.S. Army has the world's largest and most capable utility helicopter fleet, but the redesign of the XVIII Airborne Corps as an air-mechanized formation will tax this fleet heavily. Until the Army fields AAN's Joint Transport Rotorcraft, the limited capabilities of its existing transport helicopters will severely constrain the development of any air-mechanized Precision Maneuver force. For the time being, these forces will have to rely upon aging UH-60 Blackhawk and CH-47 Chinook aircraft. The Army developed the Blackhawk in the 1970s as the replacement for the Vietnam-era UH-1 Huey. There are currently 1600 Blackhawks in the force,

a third of these in the Reserve Component. Sixty percent of these aircraft are UH-60A models; the remainder are the improved L model aircraft. For the purposes of air-mechanization, the most significant difference between these models is that the L model can sling load four tons, while the A model only slings three and a quarter tons. Both aircraft have a combat radius of 185 kilometers with a sling load.[8] The Chinook is an older airframe that serves as the Army's sole heavy lift helicopter. All 450 of the CH-47s in the force are D models; 200 are in the Reserves. The Chinook can sling load nine and a quarter tons within a 150 kilometer combat radius or up to eleven tons for short 30-50 kilometer hops.[9] While both the UH-60 and CH-47 can self-deploy using additional fuel stores, such operations are unlikely because they subject the aircraft to enormous wear and tear just getting into theater. Thus excepting operations in Central America and the Caribbean, the availability of air and sea lift will continue to meter the initial corps' deployability from CONUS. Given all these limitations, the initial Precision Maneuver rapid reaction corps' combat units must have systems that can be slung under the more plentiful and survivable Blackhawk.

The German *Wiesel* armored fighting vehicle provides a viable platform for air-mechanization within the parameters outlined above. (See Figure 13) This vehicle weighs only three tons combat loaded. Its low weight and small size make it extremely easy to deploy by air over strategic distances. By way of comparison, the *Wiesel* weighs less than a HMMWV and requires only half the cubic volume of that vehicle. Since an unmodified cargo Boeing 747 can transport 24 of these vehicles, the availability of hundreds of these aircraft in the civilian aviation market would enhance the strategic mobility of a *Wiesel*-equipped Precision Maneuver corps. Much as pre-positioning afloat now increases the responsiveness of heavy forces, one could imagine the Army renting dozens of the 747s in storage in the American Southwest and keeping them loaded and ready to deploy on short notice. The *Wiesel* also enjoys great operational and tactical air mobility. A C-130 can carry three internally. Both the CH-53 and CH-47 transport helicopters can carry two internally. Most importantly, a UH-60L can sling load a combat loaded *Wiesel*.[10]

The *Wiesel* also provides sufficient protection and ground mobility for Precision Maneuver tactics. Its conventional steel armor furnishes passive protection against artillery fragments and projectiles up to 7.62mm. One could easily envision a U.S.-produced *Wiesel* derivative with ceramic armor and an active protection system that would have greatly enhanced survivability. A civilian *Volkswagen* turbo diesel engine producing 86 horsepower and mated to a three speed automatic transmission provides power to the *Wiesel's* continuous band track. This affords the vehicle a high road speed and a 300 kilometer operating radius with an 23.5 gallon fuel tank. Its cross-country mobility is better than an M-1 tank's and is comparable to the M-973 Small Unit Sustainment Vehicle.[11] A number of *Wiesel* variants including ATGM, cannon, and mortar armed models exist already. The command and control variant and an armored personnel carrier capable of transporting six infantrymen would figure prominently within the corps.[12]

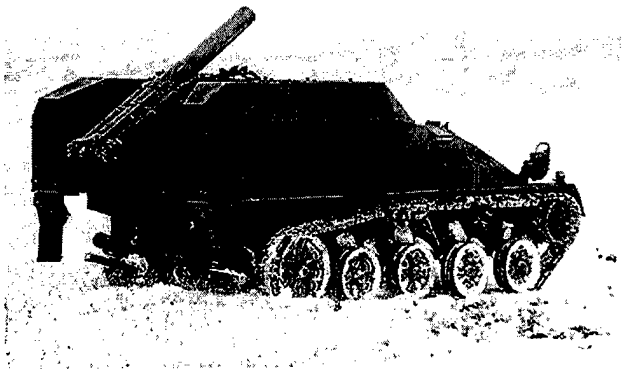

Figure 13 The *Wiesel* mortar variant is an example of the family of air-transportable armored fighting vehicles armed with precision weapons available to equip the initial Precision Maneuver rapid reaction corps. *MAK System Gesellschaft MBH - Light Airtransportable Armoured Systems* [WWW page] (The Website for Defence Industries - Army, 2000 [cited 26 March 2000]); available from http://www.army-technonology.com/contractors/armoured/mak/index.html.

The active protection system mentioned above falls within the third category of existing technologies that would enable the creation of a rapid reaction Precision Maneuver corps by the end of the decade. An active protection system (APS) is "a defensive system designed to

intercept, destroy, or confuse attacking enemy munitions."[13] Whereas the current generation of armored fighting vehicles relies on heavy passive and reactive armor suites to enhance their survivability in a direct-fire battle future light and medium weight combat vehicles will require APS systems. The ability of these systems to protect soldiers and their equipment from the lethal effects of enemy fire make them an essential technology for both the rapid reaction corps and the Army Transformation Plan.

There are currently two major types of APS. Hard kill systems destroy enemy projectiles and missiles in close proximity to their target. Soft kill systems confuse or divert enemy missiles using some combination of obscurants, jammers, decoys and signature reduction.[14] Many nations such as Japan, Sweden, France and Israel have or are developing soft kill systems. The United Kingdom, Canada, Israel and the United States are pursuing hard kill APS systems.[15] Russia has fielded three APS systems. About 1982, they introduced the *Drozd* system that uses radar to sense incoming missiles then fires rockets into their flight path to destroy or divert them. This system saw combat in Afghanistan where it reportedly achieved 80% effectiveness. The second, and newer Russian APS is the *Shotora*. This 1993 vintage system employs an electro-optical jammer and automatic signature reduction to defeat ATGM guidance systems. It also defeats laser range-finders and designators by firing aerosol screening grenades that defuse laser beams aimed at the host vehicle. Finally, *Arena*, also introduced in 1993, is a second-generation APS system similar to *Drozd*.[16]

The Russian experience with these three APS systems suggests that such systems have limitations that would reduce their value to an air-mechanized formation. The Russians designed their APS systems to operate in conjunction with Explosive Reactive Armor (ERA) suites. ERA tends to be heavy and taxes the propulsion and suspension systems of AFVs. This and the cost of APS systems (*Arena* costs $300,000 a set) has led the Russians to limit the application of APS to only their most modern and expensive main battle tanks. In their opinion, it is neither cost effective nor practical to mount APS and ERA on their BMP family of vehicles.[17]

Current American APS programs and the imperative of forging ahead with air-mechanized Precision Maneuver suggest otherwise. Since 1993, Boeing has been under a government contract to develop the Small, Low-cost Interceptor Device (SLID). (See Figure 13) This system is capable of broad vehicular and point defense applications to defeat direct and indirect fire precision munitions up to 250 meters from their target. Though not yet in production, SLID is a reality today, having had its demonstration flight in 1998. Boeing is also developing an advanced SLID variant with a two kilometer stand-off range capable of providing point protection against cruise missiles and unmanned aerial vehicles.[18] Thus, APS technology is apparently sufficiently mature for the Army to begin fielding it within an air-mechanized rapid reaction corps in this decade.

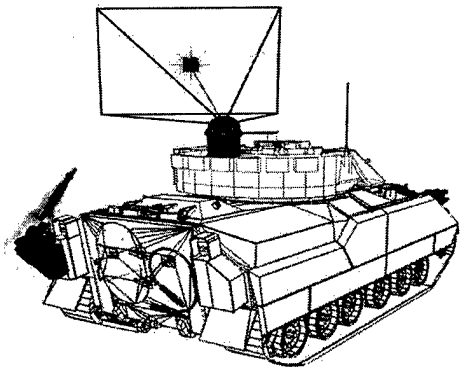

Figure 14 Artist's Conception of the Small, Low-cost Interceptor Device Mounted on an M–2 Bradley Fighting Vehicle. *Small Low-cost Interceptor Device* [WWW page] (Boeing Missile Systems & Tactical Weapons, 2000 [cited 29 March 2000]); available from http://www.boeing.com/defense-space/missiles/slid/slid.htm.

The final technology required to produce a Precision Maneuver rapid reaction corps is the most advanced and readily available: precision weapons. Among the many weapons currently underdevelopment or in production by American industry, five stand out as being particularly useful to such a corps. These are the 120mm mortar, the Enhanced Fiber Optic Guided Missile, the High Mobility Artillery Rocket System, Ground Hellfire missile, and Line-of-Sight Antitank rockets.

The tactics suggested by the Army After Next Project place a premium on precision indirect fire systems. The first three precision weapons all address this need. The M-120 120mm mortar is perhaps the simplest and most readily adaptable to the *Wiesel* platform. It could provide the corps' maneuver battalions with an organic fire support system capable of delivering obscurants, suppressive fires, and precision-guided munitions out to 7200 meters.[19]

The Enhanced Fiber Optic Guided Missile (EFOGM) system has tremendous potential as the precision strike indirect fire weapon of choice in the redesigned rapid reaction corps. (See Figure 15) The EFOGM emerged from within the Army laboratory system in the early 1980's as a tactical deep attack antitank weapon. By 1985, the Air Defense Artillery Branch had become its primary proponent as it became part of the Forward Area Air Defense (FAAD) system of systems. Temporarily renamed the Non-Line of Sight System, air defenders extensively tested EFOGM as a weapon for destroying helicopters operating behind masking terrain features. When FAAD died after the collapse of the Soviet Union, EFOGM survived within the Army labs thanks to the persistence of its father and his skill in getting Congressional support for the system even when the Army had little interest.[20] In its current configuration, the prototype EFOGM system mounts eight missiles and the fire control system on a CH-47D-transportable heavy HMMWV variant. This fire unit can control two missiles simultaneously in flight.[21] The missile itself uses a TOW2 warhead that is vulnerable to countermeasures unless re-engineered to accommodate a multi-stage warhead such as the TOW2B. It has a 15 kilometer range, but this is easily extendable, especially once industry delivers the wireless command link currently in testing.[22] The Army could mount an extended-range EFOGM system with an enhanced warhead and a wireless command system on the *Wiesel* or package it in a trailer towed behind that vehicle. Either solution would create just the kind of air-delivered, mobile, protected precision firepower system the Army will need for the new rapid reaction corps.

The final precision indirect fire system needed for the corps is the High Mobility Artillery Rocket System (HIMARS). Mounted on a 5 ton truck chassis, HIMARS is a C-130 air-transportable, multiple launch rocket system. Like the M-270 Multiple Launch Rocket System

from which the Army derived it, HIMARS is capable of delivering both high volume and precision long-range fires. It carries either a single six rocket pod or a single Army Tactical Missile. The current program goal is to field first HIMARS-equipped battalion by the end of FY04.[23] HIMARS seems ideally suited to equip the rocket artillery regiments of the initial Precision Maneuver rapid reaction corps and its air maneuver divisions. A low-weight remotely-fired, trailer mounted HIMARS variant also has potential applications within the air-mechanized force.[24]

Figure 1 EFOGM Fire Unit. *Enhanced Fiber Optic Guided Missile* [WWW page] (EFOGM Program Management Office, U.S. Army Redstone Arsenal, 17 April, 1988 2000 [cited 27 March 2000]); available from http://efogm.redstone.army.mil.

Together, the 120mm mortar, EFOGM, and HIMARS would provide the initial corps with a formidable suite of precision indirect fire systems. Nonetheless, Army After Next wargames suggest that even Precision Maneuver air-mechanized forces must close with and complete the destruction of their foes. Two direct-fire, precision weapons are especially well suited for this purpose. Despite the fact that this missile is widely used in Army Aviation, there has been regrettably little interest in a ground-mounted AGM-114L Longbow Hellfire missile. In this new millimeter radar guided variant, the Hellfire offers the force a highly lethal, fire-and-forget, anti-tank weapon with a range greater than eight kilometers.[25] Provided it could be packaged within

the weight tolerances of the UH-60L, the Hellfire seems ideally suited for the tactics of the initial Precision Maneuver force. The second direct-fire system is the Line-Of-Sight Anti-Tank (LOSAT) rocket. This weapon features a kinetic energy missile with a tremendous ballistic overmatch that allows it to defeat all anticipated armored threats. It has a five kilometer range and a fire control system able to acquire and track up to 3 targets simultaneously. In its current configuration, LOSAT travels in a HMMWV carrying four missiles. This platform is C-130 air-droppable and can be slung under an UH-60L.[26] Like Hellfire, LOSAT offers air-mechanized Precision Maneuver forces an ideal weapon for ensuring their ability to dominate the direct-fire battle that will crown victory.

With a modest purchase of new equipment, the Army could transform the XVIII Airborne Corps into an initial Precision Maneuver rapid reaction corps using existing systems and off-the-shelf technologies before 2010. The corps would be capable of conducting vertical envelopment with operationally significant mobile protected formations equipped with the tools of the Precision Firepower MTR up to 150 kilometers from its staging areas. Its attack helicopters and helicopter-delivered HIMARS would have the capability of conduct deep and shaping operations informed by the Corps' robust C4ISR capabilities. The corps would then bring its two air maneuver divisions to bear in distributed precision ambushes within the same battlespace. These ambushes would begin with a rapid insertion into scattered landing zones of the maneuver forces by UH-60L and CH-47s. Once landed, these units would maneuver under armor to positions from which their EFOGMs and mortars could strike the targeted enemy force. Shielded their APS suites, *Wiesel*-borne air-mechanized infantry supported by other *Wiesels* firing cannon and missiles would then move to exploit the effects of these fires before the division re-supplies and moves on to conduct its next strike.

SUMMARY

> Speed of maneuver offers the essential finishing function that balances our already prodigious ability to kill.
> *The Annual Report on The Army After Next Project, 1997.*[27]

> Mating superior knowledge with speed of movement can provide the means to frustrate the defender's ability to acquire and mass fires and thus allow the attacker to accomplish an operationally decisive maneuver.
> *The Annual Report on The Army After Next Project, 1997.*[28]

As the 21st Century dawns, warfare is in the midst of revolutionary change. Information Age warfare characterized by knowledge, speed, and precision is slowly supplanting Industrial Age war and its reliance on mass. The advent of precision firepower is but the first tremor of this tectonic shift. As it reverberates around the globe, the Precision Firepower Military Technical Revolution will dramatically increase the lethality and reach of defensive fires. Unless the means for offensive maneuver adapt to overcome the greatly enhanced power of the defense, future soldiers will face stalemate and indecision much like their forefathers confronted in 1914.

As the world's leading economic and military power, the United States has both the resources and the incentive to sustain its ability to conduct rapid, decisive land combat. As air-mechanization's theorists and the Army After Next Project have shown, the key lies in creating air-mechanized Precision Maneuver forces that profit from the synergy created by digitization, precision firepower, and vertical envelopment. The limitations of such forces and their high cost will make them unsuited to be the bulk of the Army. Indeed, the Army Transformation Plan is already building a complementary, but much less tactically and operationally mobile force. Nevertheless, the Army must form operationally significant Precision Maneuver forces to conduct decisive land operations in the face of enemy reconnaissance surveillance complexes. Thus, the issue is no longer, whether the Army will create a Precision Maneuver rapid reaction corps but, when it will air-mechanize the XVIII Airborne Corps.

As this monograph has argued, there exists sufficient means and technology to create an initial Precision Maneuver rapid reaction corps before 2010. It would behoove the Army to embark on this project immediately. As Leon Trotsky observed "every great revolution brings ruin to the old army."[29] We are now in the midst of such a great revolution. The Precision Firepower Military Technical Revolution will painfully, slowly, but surely ruin an old Army constructed for Industrial Age direct fire battles. The nation's security demands the Army act now to build a new force, one that leads the next revolution in war by redressing the growing imbalance between fire and maneuver, one with the speed, reach, and precision required for rapid, decisive, land campaigns in the Information Age.

[1] *Statement of General Eric K. Shinseki, Chief of Staff, United States Army before the Committee on Armed Services, House of Representatives, Second Session, 106th Congress, on the Fiscal Year 2001 Budget and Posture of the United States Army, February 10, 2000* [Adobe Acrobat Document] (United States Army, Army Vision Website, 2000 [cited 5 April 2000]); available from http://www.army.mil/armyvision/docs/CSA_HASC.pdf, 11.

[2] John Gordon IV and Peter A. Wilson, "The Case For Army XXI Medium Weight Aero-Motorized Divisions: Pathway to the Army of 2020," (Carlisle Barracks: Strategic Studies Institute, U.S. Army War College, 1998), 16.

[3] Major Charles A. Jarnot, "Air-Mech Strike," *Army* 50, no. 1 January (2000),26.

[4] Ibid., 24,26.

[5] Major General James M. Dubik, Deputy Commanding General for Transformation, TRADOC, comments in response to the author's question during his address to Advanced Military Studies Program, School for Advanced Military Studies, U.S. Army Command and General Staff College, (Fort Leavenworth, Kansas, 12 April 2000)

[6] See COL Huba Wass de Czege, "How to Change an Army," *Military Review*, November 1984, 32-49..

[7] There are many good proposals for this effort already. See for example Major Charles A. Jarnot, *"Over the Phalanx;" Proposed 82d - 101st Road to Airmechanization* [Powerpoint Presentation] (1999).

[8] *UH-60 Blackhawk* [WWW page] (Federation of American Scientists, 4 March 2000 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/ac/uh-60.htm, Major Charles A. Jarnot, *"Over the Phalanx;" Proposed 82d - 101st Road to Airmechanization* [Powerpoint Presentation] (1999), slide 16 and Jarnot, "Air Mech XXI," 14-15.

[9] *Ch-47 Chinook* [WWW page] (Federation of American Scientists, 19 November 1999 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/ac/h-47.htm and Jarnot, "Air Mech XXI," 14-15.

[10] Machmud Benjamin, "Wiesel Increases Defensive Power and Versatility of the Airborne Division," *Asian Defense Journal* , no. 11 November (1991),71,74, Stanley C. Crist, "Making the Case for An Airborne Infantry Fighting Vehicle," *Armor* 104, no. 5 September-October (1995),24, Colonel Charles Lehner et al., "Light Enough to Get There, Heavy Enough to Win," *Armor* 103, no. 4 July-August (1994),11 and R.M. Orgorkiewicz, "The MaK Wiesel: a Unique Air-Transportable Armoured Vehicle," *International Defense Review* 25, no. 6 June (1992),573-574.

[11] Ibid. The *Wiesel* has a horsepower-to-ton ratio of 29 compared to 23 for an M-1 or 30 for the M-973.

[12] Some of these variants are slightly heavier. The personnel carrier, for example, weights four tons. See Orgorkiewicz, 574 and Benjamin, 74.

[13] Captain Tom J. Meyer, "Active Protection Systems: Impregnable Armor or Simply Enhanced Survivability?," *Armor* CVII, no. 3 (May-June) (1998),7.

[14] Ibid.

[15] Ibid.,10.

[16] Ibid., 8-9.

[17] Ibid., 10.

[18] Ibid. and *Small Low-cost Interceptor Device* [WWW page] (Boeing Missile Systems & Tactical Weapons, 2000 [cited 29 March 2000]); available from http://www.boeing.com/defense-space/missiles/slid/slid.htm..

[19] *M120 120mm Mortar* [WWW page] (Federation of American Scientists, 22 February 2000 2000 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/m120.htm.

[20] Tedesco interview.

[21] *Enhanced Fiber Optic Guided Missile* [WWW page] (EFOGM Program Management Office, U.S. Army Redstone Arsenal, 17 April, 1988 2000 [cited 27 March 2000]); available from http://efogm.redstone.army.mil.

[22] Colonel (retired) Vincent J. Tedesco, Jr., Senior Director for Missiles and Air Defense, Lockheed Martin, 1999 – present, and Forward Area Air Defense System TRADOC System Manager, 1986-1988. Telephonic interview by author, 28 March 2000.

[23] *High Mobility Artillery Rocket System (HIMARS)* [WWW page] (Federation of American Scientists, 23 December 1999 1999 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/himars.htm.
[24] Jarnot first suggested such a system in his 1996 MMAS thesis.
[25] *AGM-114 Hellfire* [WWW page] (Federation of American Scientists, 6 February 2000 [cited 9 April 2000]); available from http://www.fas.org/man/dod-101/sys/missile/agm-114.htm and the Tedesco interview.
[26] *Line-of-Sight Antitank Missile (LOSAT)* [WWW page] (Federation of American Scientists, 24 December 1999 1999 [cited 5 April 2000]); available from http://www.fas.org/man/dod-101/sys/land/m120.htm.
[27] "Knowledge and Speed: The Annual Report on The Army After Next Project to the Chief-of-Staff of the Army," (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1997), A-5.
[28] "Knowledge and Speed: The Annual Report on The Army After Next Project to the Chief-of-Staff of the Army," (Fort Monroe, VA: U.S. Army Training and Doctrine Command, 1997), 11.
[29] quoted in Robert Debs Heinl, Jr., ed., *Dictionary of Military and Naval Quotations* (Annapolis, MD: U.S. Naval Institute, 1966), 280.

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